The American Midland Naturalist

Published Bi-Monthly by The University of Notre Dame, Notre Dame, Indiana

VOL. 35 MARCH, 1946 No. 2

A Contribution to Our Knowledge of the Wild and Cultivated Flora of Pennsylvania—I

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The present paper comprises an annotated catalogue of 4,321 collections of Pennsylvania plants, representing some 2,185 different species, subspecies, varieties, forms, and hybrids in 977 genera and 267 families. It is one of a series of papers on the flora of each of the states of the United States and several foreign countries.[1] The sequence of families followed is that proposed in the author's preliminary classification of the plant kingdom,[2] which, in turn, is based, with modifications, on the latest available studies on the various groups—the systems of Engler & Diels and of Hutchinson being followed in major part.

It is a pleasure to acknowledge the generous and valuable assistance rendered the author by well-known experts and renowned authorities in various groups, to whom material of their groups has been sent for determination or who have studied the material in various herbaria where it is deposited, and whose surnames are given in the following catalogue immediately after the numbers of the collections which they have studied: Mr. Edward J. Alexander (*Aster, Cactaceae, Crassulaceae, Iris, Maranta, Philodendron, Zingiber*), Dr. A. LeRoy Andrews (mosses), Dr. Liberty H. Bailey (*Rubus,* cultivated plants in general), Mr. Carleton R. Ball (*Salix*), Dr. Lyman Benson (*Ranunculus*), Dr. Jacob F. Brenckle (*Polygonum*), Mrs. Agnes Chase (*Poaceae*), Dr. Robert T. Clausen (*Crassulaceae, Pteris, Selaginella*), Dr. Lincoln Constance (*Ammiaceae*), Dr. Earl L. Core (*Cyperaceae*), Mr. W. L. Dix (lichens), Dr. Bernard O. Dodge (fungi), Dr. Carroll W. Dodge (*Crocynia*), Dr. Francis Drouet (algae), Dr. Carl Epling (*Lamiaceae*), Dr. Margaret Fulford (bryophytes), Dr. Henry A. Gleason (*Galium, Poaceae*), Dr. T. H. Goodspeed (*Nicotiana*), Dr. A. J. Grout (mosses), Dr. Albert S. Hitchcock (*Poaceae*), Dr. Frank D. Kern (fungi), Mr. John F. Lewis (lichens, mosses, ferns, *Wallia*), Dr. David H. Linder (fungi), Dr. Rogers McVaugh (*Lobelia*), Mr.

1 Moldenke, H. N., A contribution to our knowledge of the wild and cultivated flora of Ohio—I, Castanea **9**:1-80. 1944; A contribution to our knowledge of the wild and cultivated flora of Florida—I, Am. Midland Naturalist **32**:529-590. 1944; A contribution to our knowledge of the wild and cultivated flora of Massachusetts—I, Torreya **45**:41-52. 1945; A contribution to our knowledge of the wild and cultivated flora of Delaware—I, Torreya **45**:106-109. 1946; A contribution to our knowledge of the wild and cultivated flora of Maryland—I, Torreya **45**:79-92. 1945; A contribution to our knowledge of the wild and cultivated flora of Ohio—II, Am. Midland Naturalist, in press. 1946.

2 Moldenke, H. N., A preliminary classification of the plant kingdom to families. 37 pp. Feb. 1944; A preliminary classification of the plant kingdom to families. Supplement I. 4 pp. Nov. 1944.

Joseph V. Monachino (*Agrostis, Aster, Dennstaedtia, Desmodium, Glyceria, Sporobolus*), Dr. William A. Murrill (fungi), Mr. Guy G. Nearing (lichens), Dr. C. R. Orton (fungi), Mr. Ernest J. Palmer (*Crataegus*), Dr. Francis W. Pennell (*Kneiffia, Scrophulariaceae*), Prof. Alfred Rehder (woody plants, especially cultivated ones), Dr. Reed C. Rollins (*Brassicaceae*), Dr. Charles Schweinfurth (*Orchidaceae*), Dr. C. L. Shear (fungi), Dr. Rolf Singer (fungi), Dr. G. L. Stebbins, Jr. (*Antennaria, Hypochaeris*), Dr. William C. Steere (mosses), Dr. John A. Stevenson (fungi), Dr. Robert S. Stratton (*Vicia*), Dr. William Trelease (*Piperaceae*), Mr. C. A. Weatherby (ferns, *Cryptomyces*), Dr. Edgar T. Wherry (*Polemoniaceae*), and Dr. Robert E. Woodson, Jr. (*Apocynum*). Many of the early collections (indicated by low collection numbers) from Snyder County were determined at the United States National Herbarium, Washington, through the courtesy of Dr. William R. Maxon, to whom they were submitted. Most of the mosses collected by John F. Lewis were checked by Dr. William C. Steere. Most of the fleshy fungi whose determinations are not specifically credited to specialists were determined in the field and the names are in general according to the interpretation of William S. Thomas' "Field Book of Common Mushrooms" (1928).

While the vast majority of the specimens cited in this paper were collected by the author, some were gathered by other collectors, but distributed under the author's series of collection numbers because of the fact that most of the actual collectors did not maintain their own series of numbers for citation purposes. The specimens thus collected by others have this fact in most cases stated on the labels, but the numbers are in each case (except in the case of T. R. Flanagan) the author's collection and distribution numbers. These other collectors whose material is cited hereinafter are as follows, with the year or years when the collections were made and with the numbers under which their collections are herein cited given in parentheses: Miss Gertrude Arbogast, 1927 (*3163, 3194*), Mr. Thomas K. Barrie, 1944 (all the material from McKean, Potter, and Wyoming Counties and most of that from Clinton County), Mr. Morris Berd and Mrs. DeEtta Berd, 1943, 1944, 1945 (all the material from Forest County, all the material from Bear Lake, Blue Jay, Brookston, Chandler's Valley, Clarendon, Deerlick, Four Mile Creek, Heart's Content, Irvington, Kinzua, Sandstone Springs, Sheffield, and Tideoute in Warren County, much of the wild material from North Warren, Russell, and Warren in Warren County), Mr. Creston R. Billow, 1925 (*2362, 2758*), Mr. Adam P. Bingaman, 1926 (*2835*), Mr. Daniel Border, 1928 (*3870*), Dr. Lee E. Boyer, 1927 (*3129*), Dr. Leon C. Chesley, 1925, 1926 (*2781, 2861*), Dr. Earl L. Core, 1931 (*6883*), Rev. Russel J. Crouse, 1924 (*1992*), Mr. Cloyd Fisher, 1928 (*3830*), Miss Elizabeth Fisher, 1925 (*2769*), Mr. Theodore R. Flanagan, 1943 (his material is cited under his own series of numbers), Miss Eleanor A. Friend, 1938 (*10715-10719*), Mr. Ernest Geisewite, 1927 (*3181*), Dr. E. M. Gress, 1937 (*10076*), Mr. J. Walter Groce, 1928, 1929 (*2968, 3821, 3829, 3853-3856, 4116, 4355*), Mr. Leolin Hayes, 1923, 1924, 1927, 1928, 1929 (*1982, 1998, 3144, 3232, 3241, 3367, 3847, 3926, 3928, 3929, 3988, 3209, 4112-4114, 4251, 4284, 4285, 4295, 4525, 4526*), Mr. Pierce Hepner, 1928 (*3830*), Dr. Lewis Herrold, 1927 (*3162*), Mrs. Anna Hoh, 1932 (*7378*), Dr. Walter S. Ide, 1927 (*3189*), Mr. Oren S. Kaltriter, 1925 (*2415*), Miss

Miriam Keim, 1939 (*11273*), Mr. George Kline, 1925 (*2429-2431*), Mr. John F. Lewis, 1925, 1926, 1927, 1928 (*2331, 2347, 2367, 2521, 2580, 2669-2678, 2702, 2742, 3077, 3078, 3328-3344, 3346, 3347, 3355, 3362-3366, 3563, 3826, 3833, 3834, 3935-3937, 4082, 4083, 4089, 6685*), Mr. Harry J. Lupfer, 1925, 1926, 1928 (*2782, 2813, 2814, 2821, 3838, 3869, 7262*), Dr. Charles E. Moldenke and Mrs. Sophia M. Moldenke, 1931, 1935 (*6699-6701, 8683, 8684*), Miss Virginia Moody, 1927 (*3164*), Mr. U. Grant Morgain, 1927 (*3352-3354, 3541-3543, 3562*), Mr. Roscoe C. North, 1932 (*6878*), Mr. William H. Rhoades, 1933 (*17080*), Rev. G. Oliver Sands, 1924 (*2109*), Mr. C. W. Simpson, 1893 (*14488-14533*), Miss Gladys M. Staub, 1928, 1929 (*3892, 4307, 5064, 5065*), Mrs. William Staub, Jr., 1931 (*6216*), Mr. William Stumpf, 1926 (*2831*), Dr. Harvey A. Surface, 1917, 1923, 1925, 1926, 1940 (*5, 1967, 1968, 1981, 1983, 2352, 2442, 2593, 2642, 2649, 3102, 11394*), and Miss Frances C. Thomas, 1927 (*3179, 3242-3244, 3246, 3320, 3359-3361, 3386, 3540*). The author is deeply grateful to these collectors for their generous cooperation in this work, and especially to Mr. Theodore R. Flanagan, to whose splendid efforts almost all the algal records of this catalogue are due, and to Mr. and Mrs. Berd for their untiring efforts in scouring the countryside for additional material. Some miscellaneous specimens from Warren County were collected and brought to the author for identification by Mr. Franklin Briggs, Mr. and Mrs. John Carter, Mr. Jonathan Evans, Mr. Robert Forthman, Mr. Preston McCracken, and Mr. Jackson Sherman, to all of whom the author's sincere thanks are due for their helpfulness. Thanks are also due to Mrs. George W. Stratton of Buck Hill Falls for her generosity in permitting specimens to be taken from her extensive naturalized woodland garden. Considerable assistance has also been rendered by my wife, Mrs. Alma L. Moldenke, and by Mr. Joseph Monachino, Mr. G. L. Wittrock, and Dr. F. J. Seaver, who have contributed many hours of their valuable time in checking information in botanical reference works and in the herbarium of the New York Botanical Garden.

This contribution includes all plants collected in or distributed from Pennsylvania by the author to the date of this writing (October 7, 1945)—not only native material, but also naturalized, escaped, persistent, waif, and cultivated material. Habitat data are given in each case to prevent confusion. It will prove of interest to note the number of cultivated species and varieties which have tended to escape and join the native flora. Doubtless many others as yet found only in cultivation in the state, will sooner or later be discovered also as escapes and perhaps eventually as naturalizations.

The present contribution provides authentication, insofar as the T. R. Flanagan and H. N. Moldenke specimens are involved, for the records published by the author in several previous papers, including "Cultivated plants" (November 18, 1938), "The spring flora of Selinsgrove, Pennsylvania, and nearby vicinity" (June 1, 1939), "An annotated and classified list of H. N. Moldenke collection numbers from no. 1 to no. 11,277, inclusive" (December 6, 1939), "The known geographic distribution of the members of the *Verbenaceae* and *Avicenniaceae*" (March 12, 1942) and "Supplement one" thereto (November 15, 1943), "Noteworthy plant records and nomenclatural

notes" in Castanea 7:123-125 (February 1, 1943), and "The observed flora of Warren, Pennsylvania, and its immediate vicinity" (April 6, 1944) and "Supplement I" thereto (November 19, 1944). Thirty-two new scientific names are officially proposed and published in the last-mentioned of these papers.

The specimens in the present catalogue are cited according to the counties in which they were collected and the counties are listed in alphabetic sequence under each species or subspecific entity. All numbers are H. N. Moldenke collection and distribution numbers except those of most of the algae, which are T. R. Flanagan numbers (as definitely indicated in those cases). The name of the identifier or verifier is given immediately after each particular number studied by that authority. Numbers not immediately followed by any specialist's name were identified by the author (except in the cases mentioned above for Snyder County plants and Lewis' mosses). In the many cases where the identification has been corrected or changed since the material was distributed, the name under which it was originally distributed is given after the number in order that appropriate corrections may be made by the curators of herbaria in which material of that number is deposited. Where the identification given herein differs in any respect from that reported in the author's "An annotated and classified list of H. N. Moldenke collection numbers from no. 1 to no. 11,277, inclusive" and his "The observed flora of Warren, Pennsylvania, and its immediate vicinity," cited above, the name under which it was cited in those lists (hereinafter referred to as the "Annotated List" and the "Observed Flora of Warren," respectively) is noted, together with sundry corrections of various typographical errors and omissions.

Herbarium specimens of the plants cited in this contribution have been deposited in many herbaria. One of the largest sets is in the herbarium of the New York Botanical Garden; other sets are in the herbaria of the Missouri Botanical Garden at St. Louis, Carnegie Museum at Pittsburgh, National Arboretum at Washington, University of Pennsylvania at Philadelphia, University of Illinois at Urbana, Duke University at Durham, N. C., Carthage College at Carthage, Ill., Cornell University at Ithaca, N. Y., Pomona College at Claremont, Calif., Naturhistoriska Riksmuseet at Stockholm, Royal Botanic Gardens at Kew, Botanisches Museum at Berlin, Botaniska Trädgard at Göteborg, Jardin Botanique de l'Université Jagellonienne at Krakow, Vaclav Skrivanak Herbarium at Vyskov, Conservatoire Botanique at Geneva, Jardin Botanique de l'Etat at Brussels, British Museum (Natural History) at London, the herbaria of the various specialists aforementioned or of the institutions with which they are connected, and in other herbaria.

Nine new scientific names are herein officially proposed for the first time, indicated in heavy-face type.

CHROOCOCCACEAE

Anacystis marginata Menegh.—Warren Co.: in tremendous colonies on very wet brick walls, Warren State Hospital, North Warren, *Flanagan 70*, det. Drouet.

OSCILLATORIACEAE

Microcoleus lacustris Gom.—Warren Co.: with *Cylindrospermum licheniforme* and other algae on moist soil under greenhouse benches, Warren State Hospital, North

Warren, *Flanagan 36*, in part, det. Drouet; with *M. vaginatus* in mud puddles along wood road near Warren State Hospital, North Warren, *Flanagan 59*, in part, det. Drouet; with *M. vaginatus* in water of mud puddles along road southwest of Warren, *Flanagan 84*, in part, det. Drouet.

Microcoleus vaginatus Gom.—Warren Co.: in recently harrowed potato field and with *Microcoleus* sp. in mud puddles among brush adjacent to fields, Warren State Hospital, North Warren, *Flanagan 18*, det Drouet, *Flanagan 19*, in part, det. Drouet; with diatoms on wet mud of road-bank along highway from North Warren to Warren, *Flanagan 31*, in part, det. Drouet; on wet banks of small streams and damp soil at edge of wood roads near Warren State Hospital, North Warren, *Flanagan 50*, det. Drouet, *Flanagan 56*, det. Drouet; with *M. lacustris* and *Chlorococcum humicola* in mud puddles along roads near Warren State Hospital, North Warren, *Flanagan 58*, in part, det. Drouet, *Flanagan 59*, in part, det. Drouet; with *Oscillatoria brevis* in mud puddles along road to bridge over creek tributary to the Conewango, North Warren, *Flanagan 60*, det. Drouet, *Flanagan 61*, in part, det. Drouet; in dried-up mud puddles along roadside north of Warren State Hospital, North Warren, *Flanagan 75*, det. Drouet; in stagnant water of roadside ditch along highway from North Warren to Warren, *Flanagan 82*, det. Drouet; in mud puddles with *M. lacustris* and on stones under running water of roadside ditches southwest of Warren, *Flanagan 84*, in part, det. Drouet, *Flanagan 90*, det. Drouet; on wet mud of wood road, Dougherty's Run, near Warren State Hospital, North Warren, *Flanagan 98*, det. Drouet; on bottom of mud puddle in driveway in front of Warren State Hospital, North Warren, *Flanagan 120*, det. Drouet.

Microcoleus sp.—Warren Co.: with *M. vaginatus* in mud puddles among brush adjacent to potato fields, Warren State Hospital, North Warren, *Flanagan 19*, in part, det. Drouet.

Oscillatoria brevis Gom.—Warren Co.: with *Microcoleus vaginatus* in mud puddles along road to bridge over creek tributary to the Conewango, North Warren, *Flanagan 61*, in part, det. Drouet.

Oscillatoria sancta Gom.—Warren Co.: in slowly running water of roadside ditches southwest of Warren, *Flanagan 92*, det. Drouet.

Oscillatoria splendida Gom.—Warren Co.: in moist soil under greenhouse benches, Warren State Hospital, North Warren, *Flanagan 81*, det. Drouet.

Phormidium minnesotense (Tild.) Drouet—Warren Co.: on soil of greenhouse benches, Warren State Hospital, North Warren, *Flanagan 35*, det. Drouet.

Phormidium uncinatum Gom.—Warren Co.: on mud under slowly running water, Dougherty's Run, near Warren State Hospital, North Warren, *Flanagan 102*, det. Drouet.

Plectonema nostocorum Gom.—Warren Co.: on soil of greenhouse benches, Warren State Hospital, North Warren, *Flanagan 34*, in part, det. Drouet; on wet mud of wood roads, Dougherty's Run, near Warren State Hospital, North Warren, *Flanagan 100*, det. Drouet.

STIGONEMATACEAE

Fischerella ambigua (B. & F.) Gom.—Warren Co.: on damp soil of shady roadside banks southwest of Warren, *Flanagan 93*, det. Drouet.

NOSTOCACEAE

Cylindrospermum catenatum B. & F.—Warren Co.: in muddy water of puddles along road northeast of Warren State Hospital, North Warren, *Flanagan 79*, det. Drouet.

Cylindrospermum licheniforme B. & F.—Warren Co.: with *Microcoleus lacustris* and other algae on moist soil under greenhouse benches, Warren State Hospital, North Warren, *Flanagan 36*, in part, det. Drouet; on very wet mud on shady roadside banks southwest of Warren, *Flanagan 95*, det. Drouet.

Cylindrospermum muscicola B. & F.—Warren Co.: on soil of potted plants of *Cordyline australis* in greenhouse, Warren State Hospital, North Warren, *Flanagan 134*, det. Drouet [erroneously cited as no. "131" on page 2 of the Observed Flora of Warren].

Cylindrospermum sp.?—Warren Co.: with *Closterium*, *Oedogonium*, *Spirogyra*, and other algae on mud and in stagnant water in roadside ditches northeast of Warren State Hospital, North Warren, *Flanagan 108*, in part, det. Drouet.

RIVULARIACEAE

Calothrix juliana B. & F.—Warren Co.: with other algae on stones under running water of creek tributary to the Conewango, near Warren State Hospital, North Warren, *Flanagan 23*, in part, det. Drouet.

LYCOGALACEAE

Lycogala epidendrum E. Fries—Warren Co.: with *Daldinia concentrica* on bark of maple trees, North Warren, *15995a*, det. Stevenson.

EUGLENACEAE

Euglena sp.—Warren Co.: profuse and bright green in very wet sandy soil of logging road in woodland, Dougherty's Run, near Warren State Hospital, North Warren, *Flanagan 103*, det. Drouet.

PALMELLACEAE

Gloeocystis vesiculosa Näg.—Warren Co.: on old wet log on wood road in woods northeast of Warren State Hospital, North Warren, *Flanagan 111*, det. Drouet.

CHLOROCOCCACEAE

Chlorococcum humicola (Näg.) Rabenh.—Warren Co.: on bark of tree-trunk at edge of woods and with *Microcoleus vaginatus* in mud puddles along wood roads near Warren State Hospital, North Warren, *Flanagan 49*, det. Drouet, *Flanagan 58*, in part, det. Drouet; with other algae on damp stones in shady woods east of Russell, *Flanagan 118*, in part, det. Drouet.

Protococcus viridis Ag.—Warren Co.: sparse on outside surface of spring barrel on old road north of ferry, North Warren, *Flanagan 9*, det. Drouet; on bark of trunk of *Strobus weymouthiana* near bank of Conewango Creek and on bark of trunk of maples at ball diamond, Warren State Hospital, North Warren, *Flanagan 26*, det. Drouet, *Flanagan 27*, det. Drouet, *Flanagan 80*, det. Drouet; on tree-trunks in shady woods east of Russell, *Flanagan 114*, det. Drouet.

Protococcus sp.—Warren Co.: on damp stones forming bridge foundation over creek tributary to the Conewango, near Warren State Hospital, North Warren, *Flanagan 24*, det. Drouet.

OÖCYSTACEAE

Chlorella vulgaris Beyer—Warren Co.: abundant on wet porcelain of laboratory sink, Warren State Hospital, North Warren, *Flanagan 119*, det. Drouet.

COELASTRACEAE

Scenedesmus quadricaudata (Turp.) Bréb.—Warren Co.: with *Spirogyra*, diatoms, and other algae in calm water in cement watering-trough and on cement inside and outside of the trough, east of Russell, *Flanagan 115*, in part, det. Drouet, *Flanagan 116*, in part, det. Drouet.

ULOTRICHACEAE

Stichococcus bacillaris Näg.—Warren Co.: with *S. subtilis* on fungus growing on birch logs in woodland, Dougherty's Run, near Warren State Hospital, North Warren, *Flanagan 106*, in part, det. Drouet; forming yellow-green growth on crayfish claws and damp stones at edge of Conewango Creek near the dam, Warren, *Flanagan 128*, det. Drouet.

Stichococcus subtilis (Kütz.) Klerck.—Warren Co.: on very wet exposed tree roots on steep road-bank along highway from North Warren to Warren, *Flanagan 30*, det. Drouet; on flower pots and on soil in greenhouse benches, Warren State Hospital, North Warren, *Flanagan 37*, det. Drouet, *Flanagan 38*, det. Drouet, *Flanagan 132*, det. Drouet; on damp stones in airing-courts, Warren State Hospital, North Warren, *Flanagan 69*, det. Drouet; with *S. bacillaris* and other algae on fungus growing on birch logs in woodland, Dougherty's Run, near Warren State Hospital, North Warren, *Flanagan 106*, in part, det. Drouet.

BLASTOSPORACEAE

Schizogonium murale Kütz.—Warren Co.: on damp sand below billboards in cleared portion of sand-pit near junction of highways north of Warren State Hospital, North Warren, *Flanagan 15*, det. Drouet, *Flanagan 17*, det. Drouet; on damp shaded soil of woodland paths, North Warren, *Flanagan 47*, det. Drouet; on damp sand of drainage ditch southwest of Warren, *Flanagan 83*, det. Drouet.

CHAETOPHORACEAE

Stigeoclonium sp.—Warren Co.: on concrete under rapidly moving water of Conewango Creek dam, Warren State Hospital, North Warren, *Flanagan 72*, det. Drouet.

TRENTEPOHLIACEAE

Trentepohlia aurea (L.) Mart.—Warren Co.: in damp sand below billboards in cleared portion of sandpit near junction of highways north of Warren State Hospital, North Warren, *Flanagan 16*, det. Drouet.

OEDOGONIACEAE

Oedogonium sp.—Warren Co.: on wet mud of stagnant pond along highway from Warren to Kinzua, *Flanagan 41*, det. Drouet; with *Tribonema bombycinum* in slightly running water of roadside ditch along the road from Kinzua to Corydon, *Flanagan 46*, in part, det. Drouet; with *Mougeotia* in damp shaded soil of woodland paths and with *Cladophora glomerata* on rocks under rapidly flowing water of mill-run overflow, Warren State Hospital, North Warren, *Flanagan 48*, in part, det. Drouet, *Flanagan 71*, in part, det. Drouet; in slowly running water of roadside ditches southwest of Warren, *Flanagan 91*, in part, det. Drouet; with *Closterium*, *Spirogyra*, *Cylindrospermum*, and other algae on mud and in stagnant water in roadside ditches and with diatoms in water of spring-barrel along road north of the ferry near Warren State Hospital, North Warren, *Flanagan 108*, in part, det. Drouet, *Flanagan 138*, in part, det. Drouet; with diatoms under running water on dam in Conewango Creek, Warren, *Flanagan 126*, in part, det. Drouet, *Flanagan 127*, in part, det. Drouet.

CLADOPHORACEAE

Cladophora glomerata (L.) Kütz.—Warren Co.: on concrete under rapidly moving water of Conewango Creek dam and with *Oedogonium* on rocks under rapidly moving water of mill-run overflow, Warren State Hospital, North Warren, *Flanagan 71*, in part, det. Drouet, *Flanagan 73*, det. Drouet; on very wet concrete wall by sluiceway and under running water on dam in Conewango Creek, Warren, *Flanagan 121*, det. Drouet, *Flanagan 122*, det. Drouet, *Flanagan 125*, det. Drouet.

Rhizoclonium hieroglyphicum (Ag.) Kütz.—Warren Co.: under running water on Conewango Creek dam, Warren, *Flanagan 124*, det. Drouet.

VAUCHERIACEAE

Vaucheria geminata (Vauch.) P. DC.—Warren Co.: on damp bank of stagnant pond along road from Warren to Kinzua, *Flanagan 42*, det. Drouet; in slowly running water of small stream near Warren State Hospital, North Warren, *Flanagan 51*, det. Drouet; on very wet soil of roadside bank along highway 69 near North Warren, *Flanagan 65*, det. as "probably" this species by Drouet.

Vaucheria sp.—Warren Co.: on rocks under gently flowing water of Dougherty's Run under railroad culvert north of Warren State Hospital, North Warren, *Flanagan 14*, det. Drouet; with diatoms in slowly running water in roadside ditches along the road from Warren to Kinzua, *Flanagan 43*, in part, det. Drouet, *Flanagan 44*, det. Drouet; on very wet soil of roadside banks along highway 69, near North Warren, *Flanagan 66*, det. Drouet; on muddy bank of roadside ditch, Dougherty's Run, near Warren State Hospital, North Warren, *Flanagan 97*, det. Drouet.

TRIBONEMACEAE

Tribonema bombycinum (Ag.) Derb. & Sol.—Warren Co.: with *Oedogonium* in slowly running water of roadside ditches along highway from Kinzua to Corydon, *Flanagan 46*, in part, det. Drouet.

DESMIDIACEAE

Closterium sp.—Warren Co.: with *Cylindrospermum*, *Oedogonium*, *Spirogyra*, and other algae in mud and in stagnant water in roadside ditches northeast of Warren State Hospital, North Warren, *Flanagan 108*, in part, det. Drouet.

ZYGNEMATACEAE

Mougeotia sp.—Warren Co.: with *Oedogonium* on damp shaded soil along woodland paths and abundant on damp boards in logging road northeast of Warren State Hospital, North Warren, *Flanagan 48*, in part, det. Drouet, *Flanagan 112*, det. Drouet.

Spirogyra sp.—Warren Co.: sparse growth in water of spring along old road north of the ferry, Warren State Hospital, North Warren, *Flanagan 8*, det. Drouet; with diatoms on aquatic plants in slowly running water of small stream and in stagnant water of roadside ditch along road north of ferry, Warren State Hospital, North Warren, *Flanagan 55*, in part, det. Drouet, *Flanagan 139*, det. Drouet; in calm water of spring pond, along with other algae, near highway 69, North Warren, *Flanagan 68*, in part, det. Drouet; in muddy water of puddles and on mud and in stagnant water of roadside ditches northeast of Warren State Hospital, North Warren, *Flanagan 78*, det. Drouet, *Flanagan 109*, det. Drouet; with *Closterium*, *Cylindrospermum*, and *Oedogonium* on mud and in stagnant water in roadside ditches northeast of Warren State Hospital, North Warren, *Flanagan 108*, in part, det. Drouet [erroneously cited as "106 in part" on page 3 of the Observed Flora of Warren]; with *Scenedesmus quadricaudata* and diatoms in calm water of cement watering-trough east of Russell, *Flanagan 116*, in part, det. Drouet; on waterlily leaves in stagnant water of pond, Crescent Park, Warren, *Flanagan 130*, det. Drouet, *Flanagan 131*, det. Drouet.

ERYSIPHACEAE

Erysiphe polygoni P. DC.—Warren Co.: on *Pisum sativum* cultivated in fields and gardens and on leaves of *Trifolium pratense* in meadows, North Warren, *15944*, det. Stevenson, *16608*, det. Stevenson.

Microsphaera alni (P. DC.) Wint.—Warren Co.: on leaves of *Syringa vulgaris*, North Warren, *16652*, det. as "*Microsphaera alni* DC. ex Wint." by Stevenson.

Sphaerotheca pannosa (Wallr.) Lév.—Warren Co.: on leaves of *Rosa borboniana* and *R. odorata* f. *ochroleuca* in greenhouse cultivation, North Warren, *16116*, det. Stevenson, *16124*, det. Stevenson.

ASPERGILLACEAE

Aspergillus herbariorum (Weber) Fischer—Warren Co.: mold on tobacco in glass jar, North Warren, *17288a*, det. Stevenson.

Penicillium crustaceum E. Fries—Warren Co.: mold on cheese-spread in glass jar, North Warren, *15726*, det. as "*Penicillium* sp." by Stevenson.

Penicillium digitatum Sacc.—Warren Co.: on rind of fruit of *Citrus nobilis* var. *deliciosa*, on orange-peel, and on tobacco, North Warren, *16160*, det. Stevenson,

17288, det. by Stevenson as "*Penicillium* sp., probably *P. digitatum*, which is usual on citrus."

PHACIDIACEAE

Cryptomyces pteridis (Rebent.) Rehm—Warren Co.: on fronds of *Pteridium latiusculum* and *P. latiusculum* f. *berdii* in open woods, Sandstone Springs, *17604a*, det. Weatherby, *17606a*, det. Weatherby.

DERMATEACEAE

Pezicula carpinea Pers.—Warren Co.: on bark of decaying logs in woods, North Warren, *17787*, det. as "*Pezicula* sp. cf. *P. carpinea* Pers. ex Tul." by Stevenson.

GEOGLOSSACEAE

Leotia stipitata (Bosc) Schröt.—Warren Co.: growing in colonies in leaf-mold of woods, North Warren, *15756*, det. Linder.

HELVELLACEAE

Morchella esculenta (L.) Pers.—Warren Co.: in leaf-mold on hillside, North Warren, *16195*.

HYPOCREACEAE

Cordyceps militaris Link—Warren Co.: on mossy tree-trunk, North Warren, *17788*, det. Stevenson.

Hypomyces chrysospermus (Bull.) Tul.—Warren Co.: on old boletes and dead leaves in woods, Bull Hill, Sheffield, *17742*.

DOTHIDEACEAE

Phyllachora vulgata Thiessen & Sydow—Forest Co.: on leaves of *Muhlenbergia mexicana*, Cook's Forest, *16799*, det. Kern and Orton.

SPHAERIACEAE

Daldinia concentrica (Bolt.) Ces. & De Not.—Warren Co.: with *Lycogala epidendrum* on bark of trunk of maple trees, North Warren, *15995*, det. Stevenson.

Didymellina iridis (Desm.) Hoehn.—Warren Co.: on leaves of *Iris germanica*, North Warren, *16578*, det. Stevenson.

Hypoxylon commutatum var. *holwayanum* Sacc. & Ell.—Warren Co.: on dead branches of *Argentacer saccharinum*, North Warren, *16731*, det. as "*Hypoxylon commutatum holwayanum* Sacc. & Ell." by Stevenson.

Hypoxylon multiforme E. Fries—Warren Co.: on dead birch limbs, Warren, *14566*, det. B. O. Dodge.

VALSACEAE

Valsa leucostoma Pers.—Warren Co.: on dead limbs of *Sorbus aucuparia*, North Warren, *16586*, det. Stevenson.

XYLARIACEAE

Camarops tubulina (Alb. & Schwein.) Shear—Warren Co.: on old tree-stumps in woods, North Warren, *17780*, det. Shear.

Xylaria longiana Rehm—Warren Co.: at base of decaying tree-stump, North Warren, *17779*, det. Stevenson: in soil at base of dead stump, Sheffield, *17857*, det. Stevenson.

Xylaria polymorpha (Pers.) Grev.—Warren Co.: colony at base of dying *Crataegus oxyacantha*, North Warren, *17735*, det. as "*Xylaria polymorpha* (Pers. ex Fr.) Grev." by Stevenson.

USTILAGINACEAE

Ustilago zeae (Beckmann) Unger—Warren Co.: in inflorescences of *Zea mays* var. *rugosa* in cornfields, North Warren, *15776*.

PUCCINIACEAE

Puccinia coronata Corda—Warren Co.: on leaves of *Avena sativa*, North Warren, *17061*, det. Kern.

Puccinia helianthi Schwein.—Forest Co.: on leaves of *Helianthus decapetalus*, Tionesta Fish Hatchery, *16817*, det. Kern. Warren Co.: on leaves of *Helianthus rigidus*, North Warren, *17002*, verif. Kern.

Puccinia malvacearum Mont.—Warren Co.: on leaves of *Althaea rosea*, overgrown by *Cladosporium herbarum*, North Warren, *17936*, det. Stevenson.

Uromyces caryophyllinus (Schrank) Wint.—Warren Co.: on leaves of *Dianthus caryophyllus* var. *longicaulis* in greenhouse cultivation, North Warren, *16117*, det. Stevenson, *16145*, det. Kern.

COLEOSPORIACEAE

Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long—Warren Co.: on leaves of *Euthamia graminifolia* var. *nuttallii* in fields and along hedgerows, North Warren, *15858*, det. Kern.

Coleosporium solidaginis (Schwein.) Thüm.—Warren Co.: on leaves of *Pinus resinosa*, North Warren, *16438*, det. Kern.

MELAMPSORACEAE

Pucciniastrum agrimoniae (Schwein.) Trantz.—Warren Co.: on leaves of *Agrimonia gryposepala* in woodlands, North Warren, *15859*, det. Kern.

TREMELLACEAE

Exidia glandulosa E. Fries.—Warren Co.: black slimy ooze on dead limbs of *Saccharodendron saccharum*, North Warren,, *16620*, det. Stevenson.

Tremellodendron candidum (Schwein.) Atkinson—Warren Co.: growing in colonies in dense leaf-mold in deep woods, North Warren, *15507*, det. Linder, *15751*, det. Linder, *17786*, det. Stevenson.

Tremellodendron merismatoides (Schwein.) Burt.—Warren Co.: colonial in woods, North Warren, *17873*, det. Stevenson.

Tremellodendron tenax (Schwein.) Burt.—Warren Co.: among fallen needles in pine woods along Four Mile Creek, *18061*, det. Stevenson.

DACRYOMYCETACEAE

Guepinia spathularia E. Fries—Warren Co.: growing in dense rows in cracks of dead logs, North Warren, *15655*, det. Linder.

THELEPHORACEAE

Craterellus cantharellus (Schwein.) E. Fries—Warren Co.: in dense woods, North Warren, *15719*, det. Singer.

Peniophora cinerea (Pers.) Cooke—Warren Co.: on dead limbs, about 2 miles west of Warren, *15178*, det. Linder; on dead limbs and twigs of *Tilia americana*, *Fagus sylvatica* var. *atropunicea*, *Ulmus americana*, *Salix fragilis*, *Saccharodendron saccharum*, and other trees, North Warren, *15185*, det. Linder, *15215*, det. as "*P. cinerea* vel aff." by Linder, *16549*, *16550*, *16552*, *16585*, *16610*. The last five of these collections were det. as "*Peniophora cinerea* Fr." by Stevenson.

Peniophora sp.—Warren Co.: on dead limbs and twigs of *Hamamelis virginiana* and *Padus virginiana*, North Warren, *16683*, det. Stevenson.

CORTICIACEAE

Stereum fasciatum Schwein.—Warren Co.: on dead limbs in woodlands, North Warren, *15502*.

Stereum ochraceo-fulvum Schwein.—Warren Co.: on dead branches, badly weathered and sterile, North Warren, *14917*, det. Linder.

Stereum rameale Schwein.—Warren Co.: on dead limbs and branches, North Warren, *15616*, det. Linder, *17778*, det. Stevenson, who comments "not quite typical, but possibly due to immaturity."

Stereum sericeum Schwein.—Warren Co.: on dead twigs and branches in woodlands, North Warren, *15717*, det. Linder, *17777*, det. Stevenson.

CLAVARIACEAE

Clavaria cristata (Holmsk.) Pers.—Warren Co.: on floor of dense woods between Irvington and Tideoute, *17497*, det. as "*C. cristata* (Holmsk.) Pers. ex Fr." by Stevenson.

Clavaria pulchra Peck—Forest Co.: on floor of dense woods along Tionesta Creek from Henry's Mills to Kelletville, *17659*, det. Shear. Warren Co.: colonial in dense leaf-mold in damp woods, North Warren, *17783*, det. as "*Clavaria* sp. not well developed, but apparently *C. pulchra* Pk." by Stevenson, *17877*, det. Stevenson.

Clavaria subfalcata Atkinson—Warren Co.: colonial in dense woods, North Warren, *15750*, det. as "*C. subfalcata* sensu Coker" by Linder.

Clavaria sp.—Warren Co.: on floor of pine woods along Four Mile Creek, *18068*, det. with a question by Stevenson.

Pterula densissima Berk. & Curt.—Warren Co.: colonial on soil under *Syringa vulgaris*, North Warren, *17843*, det. Stevenson, who says "rare! This is the only abundant collection ever received."

HYDNACEAE

Odontia sp.—Warren Co.: on dead limbs in woods along Deerlick stream, Deerlick, *17167*, det. Stevenson.

POLYPORACEAE

Coriolus abietinus (Dicks.) Quél.—Warren Co.: on bark of dead tree-trunk, North Warren, *15613*, det. as "*C. pargamenus* (Fr.)" by Linder.

Coriolus hirsutulus (Schwein.) Murrill—Warren Co.: on decaying logs in woods, North Warren, *17784*, det. as "*Polyporus hirsutulus* Schw." by Stevenson.

Coriolus versicolor (L.) Quél.—Warren Co.: on decaying stems of *Syringa vulgaris*, tree-trunks, dead stumps, and logs in woods, North Warren, *14619*, det. Murrill, *15186*, det. Murrill, *15615*, det. Linder, *17785*; on wooden flower-pots in greenhouse, North Warren, *15111*, det. Murrill; on dead limbs of *Syringa amurensis* about two miles west of Warren, *15179*, det. Murrill; on dead limbs, between Sheffield and Brookston, *18135*, det. as "*Polyporus versicolor* L. ex Fr." by Stevenson.

Daedalea confragosa (Bolt.) Pers.—Warren Co.: on bark of decaying logs and stumps in woods, North Warren, *16992*, det. as "*D. confragosa* Bolt. ex Fr." by Stevenson, *17781*, det. as "*D. confragosa* Fr." by Stevenson.

Daedalea quercina (L.) Pers.—Snyder Co.: on tree-trunks in woods, Selinsgrove, *4177*.

Elfvingia applanata (Pers.) P. Karst.—Warren Co.: on dead stumps in woodlands, North Warren, *15503*, det. as "*Ganoderma applanatum* (Pers.) Pat." by Linder.

Elfvingia megaloma (Lév.) Murrill—Warren Co.: on stems of *Syringa vulgaris*, Warren, *14577*, det. Murrill; on decaying logs in woodlands, North Warren, *15766*, *17782*.

Fomes pinicola Sw.—Warren Co.: on trunk of *Tsuga canadensis* in woodland, North Warren, *16100*, det. Stevenson.

Ganoderma applanatum (Pers.) Pat.—Warren Co.: on living tree of *Saccharodendron saccharum* and on bark of dead stumps and tree-trunks in woods, North Warren, *16993*, *16994*. Both these collections were det. as "*Fomes applanatus* (Pers. ex Fr.) Gill." by Stevenson.

Laetiporus sulphureus (Batt.) Murrill—Warren Co.: forming tremendous spiral colonies on decaying stumps, between Sheffield and Brookston, *18133*.

Lenzites saepiaria Wulf.—Warren Co.: on old railroad ties along tracks between Sheffield and Brookston, *18134*, det. as "*L. saepiaria* Wulf. ex Fr." by Stevenson.

Lenzites trabea Pers.—Warren Co.: on dead limbs, between Sheffield and Brookston, *18136*, det. as "*L. trabea* Pers. ex Fr." by Stevenson.

Polyporus brumalis (Pers.) E. Fries—Warren Co.: on decaying logs, Bull Hill, Sheffield, *17743*.

Polyporus tulipiferus (Schwein.) Overh.—Warren Co.: on dead limbs and branches of *Padus virginiana* and *Saccharodendron saccharum*, North Warren, *15996*, det. Steveenson, *16682*, det. Stevenson.

Poria punctata E. Fries—Warren Co.: on dead limbs of *Xylosteon tataricum* in cultivation, North Warren, *14843*, det. Linder.

Poronidulus conchifer (Schwein.) Murrill—Warren Co.: on dead limbs, Warren, *14565*, det. Murrill; on dead limbs, North Warren, *15184*, det as "*Polyporus conchifer* (Schw.) Fr." by Linder.

Pcynoporus cinnabarinus (Jacq.) P. Karst.—Warren Co.: on dead twigs, North Warren, *14620*, det. Murrill.

Tyromyces spraguei (Berk. & Curt.) Murrill—Warren Co.: on dead stumps in woodlands, North Warren, *15718*, det. as "*Polyporus Spraguei* B. & C." by Linder.

AGARICACEAE

Agaricus arvensis Schaeff.—Warren Co.: in moist woods, North Warren, *15394*.

Agaricus campestris L.—Snyder Co.: in lawns, Selinsgrove, *4188*. Warren Co.: in lawns and greenhouse benches, North Warren, *15513*.

Amanita muscaria (L.) Pers.—Warren Co.: in dense woodlands, Chandler's Valley, *17829*.

Amanita phalloides E. Fries—Warren Co.: in dense woodlands, North Warren, *17663*.

Camarophyllus cantharellus (Schwein.) Murrill—Warren Co.: in deep dense woodland, Bull Hill, Sheffield, *17739*.

Chanterel chantarellus (L.) Murrill—Warren Co.: in damp woods, North Warren, *16999*.

Clitocybe adirondackensis (Peck) Sacc.—Warren Co.: in dark woods, North Warren, *15743*, det. Singer.

Clitocybe illudens Schwein.—Warren Co.: in dense woodlands, forming large colonies, North Warren, *15614*, verif. Linder.

Clitocybe multiceps Peck—Warren Co.: colonial in moist woods, North Warren, *16998*.

Clitocybe tabescens (Scop.) Bres.—Warren Co.: in dense woodlands, North Warren, *15720a*, det. with a question by Linder.

Collybia butyracea (Bull.) Quél.—Warren Co.: in dark woods, North Warren, *15744*, det. with a question by Singer.

Collybia confluens Pers.—Warren Co.: in damp woods, North Warren, *17001*.

Collybia radicata (Rehl.) Berk.—Warren Co.: in deep woods, Bull Hill, Sheffield, *17730*.

Coprinus comatus (F. Muell.) E. Fries—Warren Co.: in greenhouse benches, North Warren, *17058*.

Coprinus micaceus (Bull.) E. Fries—Warren Co.: in greenhouse benches, North Warren, *16151*.

Cortinarius alboviolaceus (Pers.) E. Fries—Warren Co.: in damp woods, North Warren, *17871*.

Crepidopus ostreatus (Jacq.) S. F. Gray—Warren Co.: on decaying logs in woodlands, North Warren, *15225*, det. as "*Pleurotus ostreatus* (Jacq.)" by Linder.

Entoloma commune Murrill—Warren Co.: in dense damp woods, North Warren, *17790*, *17874*.

Galerula crispa (Longyear) Murrill—Warren Co.: forming large colonies in lawns, North Warren, *15018*, det. Murrill.

Gymnopilus flavidellus Murrill—Warren Co.: in damp woods, between Irvington and Tideout, *17520;* in rich dense woods, North Warren, *17792.*

Gymnopus platyphyllus (Pers.) Murrill—Warren Co.: in woods, North Warren, *15745.*

Hypholoma lateritium (Schaeff.) Quél.—Warren Co.: forming dense colonies in lawns, North Warren, *16021;* colonial in dense woods, Deerlick road, near Sheffield, *17261.*

Inocybe sp.—Warren Co.: in woodlands, North Warren, *17993,* det. with a question by Stevenson.

Lactaria hygrophoroides Berk. & Curt.—Warren Co.: in woods, North Warren, *15746,* det. as "*Lactarius hygrophoroides*" by Singer.

Lactaria piperata (L.) Pers.—Warren Co.: in damp woods, North Warren, *15747,* det. as "*Lactarius piperatus*" by Singer, *17872.*

Lentinus levis Berk. & Curt.—Warren Co.: in woodlands, North Warren, *15749,* det. Singer.

Lentinus squamosus (Schaeff.) Murrill—Warren Co.: in deep damp woods, Bull Hill, Sheffield, *17737.*

Lepiota naucina (E. Fries) Quél.—Warren Co.: in damp woods, North Warren, *17875.*

Lepiota procera (Scop.) E. Fries—Warren Co.: in damp woods, North Warren, *17870.*

Marasmius caryophylleus (Schaeff.) Schröt.—Warren Co.: in lawns, North Warren, *15659,* det. as "*M. oreades*" by Singer.

Marasmius rotula (Scop.) E. Fries—Warren Co.: on bark of decaying logs in woods, Bull Hill, Sheffield, *17466, 17740.*

Omphalopsis caulicinalis (Sow.) Singer—Warren Co.: in dense woods, North Warren, *15755,* det. Singer.

Omphalopsis fibula Murrill—Warren Co.: in leaf-mold on floor of woods, North Warren, *17662.*

Oudemansiella radicata (Rel.) Singer—Warren Co.: in woodlands, North Warren, *15876,* det. Linder.

Paxillus involutus (Batsch) E. Fries—Warren Co.: in damp woods, North Warren, *17000.*

Pholiota caperata (Pers.) Geill. sensu W. S. Thomas, Field Book of Common Mushrooms, p. 233. 1928—Warren Co.: in moist woods, North Warren, *17793.*

Pluteus cervinus (Schaeff.) Quél.—Warren Co.: clustered in moist woodlands, North Warren, *15396.*

Prunulus purus (Pers.) Murrill—Warren Co.: in dense woodlands, North Warren, *17791.*

Russula emetica (Schaeff.) E. Fries—Warren Co.: in woods, North Warren, *15506,* det. with a question by Linder.

Russula virescens (Schaeff.) E. Fries—Warren Co.: solitary in moist woodlands, North Warren, *15395.*

Schizophyllus alneus (L.) Schröt.—Warren Co.: on bark of dead tree-trunks, North Warren, *15505,* det. as "*Schizophyllum commune* Fr." by Linder; on decaying logs, Bull Hill, Sheffield, *17736.*

Stropharia coronilla (E. Fries) Quél.—Warren Co.: in moist woodlands, North Warren, *15879,* det. Singer.

Vaginata plumbea (Schaeff.) Murrill—Warren Co.: in moist woodlands, North Warren, *15720,* det. as "*Amanitopsis vaginata*" by Linder, *15752,* det. as "*Amanitopsis vaginata* sensu latu" by Singer; in dense damp woods, Bull Hill, Sheffield, *17745.*

BOLETACEAE

Ceriomyces pallidus (Frost) Murrill—Warren Co.: in moist woodlands, North Warren, *15875,* det. as "*Boletus pallidus?*" by Linder.

Ceriomyces viscidus (L.) Murrill—Warren Co.: in dense damp woods, Bull Hill, Sheffield, *17744.*

Fistulina hepatica (Huds.) E. Fries—Warren Co.: on dead trunks and stumps of *Castanea dentata* in woodlands, North Warren, *15617*, verif. Linder.

Strobilomyces strobilaceus (Scop.) Berk.—Warren Co.: solitary in woodlands, North Warren, *15510*.

Tylopilus felleus (Bull.) P. Karst.—Warren Co.: solitary in moist dense woods, North Warren, *15397*, *17789*.

SCLERODERMACEAE

Scleroderma aurantium (Vaill.) Pers.—Warren Co.: solitary in leaf-mold in dense woodlands, North Warren, *15508*, det. Linder.

Scleroderma lycoperdoides Schwein.—Warren Co.: in moist woodlands, North Warren, *15656*, det. Linder, inaccurately recorded as "*S. lycoperdioides*" on page 4 of the Observed Flora of Warren.

LYCOPERDACEAE

Lycoperdon gemmatum Batsch—Warren Co.: in grassy fields east of Russell, *16846*, det. at "*Lycoperdon* sp." by Stevenson; on rotting logs in woods and on soil in moist meadows, North Warren, *16996*, *17761*.

Lycoperdon pyriforme Schaeff.—Warren Co.: in dense colonies at base of dead stumps in woodlands, North Warren, *15874*, det. Linder; on decaying logs in dense woods, Chandler's Valley, *17830*.

NIDULARIACEAE

Cyathus stercoreus (Schwein.) De Toni—Warren Co.: on ground and horse manure, North Warren, *15945*.

PHALLACEAE

Ithyphallus impudicus (L.) E. Fries—Warren Co.: in damp woods between Irvington and Tideoute, *17519*.

SPHAERIOIDEACEAE

Phyllosticta acericola Cooke & Ellis—Warren Co.: on leaves of *Rufacer rubrum* in woodlands, North Warren, *15843*, det. Kern.

MELANCONIACEAE

Marssonia juglandis (Lib.) Sacc.—Warren Co.: on leaves of *Wallia nigra* in cultivation, North Warren, *15926*, det. Kern.

Stilbospora pyriforme Hoffm.—Warren Co.: on dead twigs, North Warren, *15983*, det. Stevenson.

MONILIACEAE

Botrytis cinerea Pers.—Warren Co.: on fallen flowers of *Abutilon* and *Hibiscus* on greenhouse benches, apparently not attacking other flowers, North Warren, *16127*, det. Stevenson.

Botrytis hortensis Ellis & Ev.—Warren Co.: on fallen flowers of *Abutilon* and *Hibiscus* on greenhouse benches, North Warren, *14564*, det. B. O. Dodge.

Monilia fructicola (Wint.) Honey—Warren Co.: on fruit of *Prunus domestica*, North Warren, *16995*, det. Stevenson.

DEMATIACEAE

Acremoniella atra (Corda) Sacc.—Warren Co.: on bark of dead limbs and twigs of *Ulmus glabra* f. *pendula*, North Warren, *14859*, *16439*, det. with a question by Stevenson.

Alternaria tenuis Nees—Warren Co.: mold on old gourds and on stems of *Hibiscus syriacus*, North Warren, *17098*, det. Stevenson, *17937*, det. Stevenson.

Cladosporium herbarum (Pers.) Link—Warren Co.: overgrowing *Puccinia malvacearum* on leaves of *Althaea rosea*, North Warren, *17936a*, det. as "*C. herbarum* Fr." by Stevenson.

Polythrincium trifolii Kunze—Warren Co.: on leaves of *Trifolium repens* in lawns, North Warren, *17062*, det. Kern.

TUBERCULARIACEAE

Fusarium sp.—Warren Co.: on old gourds, leaves of *Morus alba*, and stems of *Hibiscus syriacus*, North Warren, *16656*, det. Stevenson, *17097*, det. Stevenson, *17099*, det. Stevenson, *17937a*, det. Stevenson.

Tubercularia vulgaris (Tode) E. Fries—Warren Co.: on dead limbs and stems of cultivated roses and *Magnolia soulangiana*, North Warren, *14691*, det. Linder, *16097*, det. Stevenson, *16679*, det. as "*T. vulgaris* Fr." by Stevenson.

PELTIGERACEAE

Peltigera canina (L.) Willd.—Warren Co.: among moss on large rock along stream, Bull Hill, Sheffield, *17725*, det. Nearing.

LECIDEACEAE

Bilimbia melaena (Nyl.) Arn.—Warren Co.: on rotting logs in woodlands, North Warren, *16046a*, det. Nearing.

Psora ostreata Hoffm.—Warren Co.: on trunks of *Quercus velutina* in woodlands, North Warren, *15870*, det. as "*P. ostreata* or perhaps *P. anthracophila* (Nyl.) Arn." by Nearing.

CLADONIACEAE

Cladonia bacillaris (Ach.) Nyl.—Warren Co.: in rocky woods between Sheffield and Brookston, *18152a*, det. Dix.

Cladonia caespiticia (Pers.) Floerke—Warren Co.: an abundance of primary squamules mixed with *C. coniocraea* and *Hypnum imponens* on mossy boulder in dense woodlands, North Warren, *15469a*, det. Dix, who says "appear to belong to *C. caespiticia*."

Cladonia chlorophaea (Floerke) Spreng.—Warren Co.: in woodlands, Sheffield, *17349*, det. Dix, *17368*, det. Dix, *17369*, det. Dix; on soil of overhanging banks, North Warren, *17800*, det. Dix.

Cladonia chlorophaea f. *simplex* (Hoffm.) Arn.—Warren Co.: on flat procumbent and mossy boulders in dense woodlands, among mosses in woods, and on soil of overhanging banks, North Warren, *15467*, det. Dix, *16040*, det. Dix, *17124*, det. Dix,[3] *17797*, det. Dix; with mosses in woodlands along Deerlick stream, Deerlick, *17133*, det. Dix,[3] *17143*, det. Dix;[3] on banks, between Sheffield and Brookston, *18143*, det. Dix.

Cladonia coniocraea (Floerke) Spreng.—Warren Co.: among moss on boulders and decaying logs in woodlands, North Warren, *15469*, det. Dix, *16042*, det. Dix, *16043*, det. Dix; among mosses in moist dense woodlands along Deerlick stream, Deerlick, *17154*, det. Dix,[4] *17164*, det. Dix;[4] on prostrate logs in moist woods, Deerlick road, near Sheffield, *17260*, det. Dix, *17274*, det. Dix; in damp woodlands, Bull Hill, Sheffield, *17450*, det. Dix, *17452*, det. Dix, *17453a*, det. Dix.

Cladonia coniocraea f. *ceratodes* (Floerke) Dalla Torre & Sarnth.—Warren Co.: among moss on prostrate logs in woods along Deerlick stream, Deerlick, *17144*, det. as "*C. coniocraea* f. *ceratodes* Della Torre & Sarnth." by Dix, who says this is the first record from the county.

Cladonia cristatella Tuckerm.—Warren Co.: on procumbent rotting logs in woodlands, North Warren, *16037a*, det. Dix; among moss and on banks in woodlands along

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[3] As "*C. chlorophaea* f. *simplex* Arn."

[4] As "*C. coniocraea* Spreng."

Deerlick stream, Deerlick, *17146*, det. Dix, *17161*, det. Dix; on prostrate logs in woods, Deerlick road, near Sheffield, *17273*, det. Dix; in damp woodlands, Bull Hill, Sheffield, *17450a*, det. Dix, *17453*, det. Dix, *17454*, det. Dix; in rocky woods between Sheffield and Brookston, *18151*, det. Dix.

Cladonia cristatella f. *beauvoisii* (Del.) Vainio—Warren Co.: on soil of overhanging banks and along old wood roads, North Warren, *14818*, det. Dix, det. as "*C cristatella*" by Nearing, *17799*, det. Dix; on bark and among mosses in moist woods along Deerlick stream, Deerlick, *17135*, det. Dix,[5] *17136*, det. Dix,[5] *17152*, det. Dix,[5] *17153*, det. Dix;[5] in rocky woods and in shallow humus on boulders between Sheffield and Brookston, *18149*, det. Dix, *18150*, det. Dix, *18152*, det. Dix.

Cladonia cristatella f. *scyphulifera* Sandst.—Warren Co.: among mosses in moist woods along Deerlick stream, Deerlick, *17134*, det. Dix, *17152a*, det. Dix, *17158*, det. Dix, who says that this is the first record from the county.

Cladonia cristatella f. *vestita* Tuckerm.—Warren Co.: on mossy boulders in dense woodlands and on soil of overhanging banks, North Warren, *15468*, det. Dix, *17799a*, det. Dix; in damp woodlands, Bull Hill, Sheffield, *17449*, det. Dix, *17451*, det. Dix; in shallow humus on boulders between Sheffield and Brookston, *18148*, det. Dix.

Cladonia deformis (L.) Hoffm.—Warren Co.: in open woods, Bull Hill, Sheffield, *17115*, det. as "*C. deformis* Hoffm." by Dix, who says that this is the first record of the species from the county and the fourth collection from the state.

Cladonia delicata (Ehrh.) Floerke—Warren Co.: in soil mat over rotting log in woods, North Warren, *16047*, det. Dix.

Cladonia fimbriata (L.) E. Fries—Warren Co.: on rocks along wood roads, North Warren, *15726*, det. Dix; in woodlands, Sheffield, *17350*, det. with a question by Dix.

Cladonia furcata (Huds.) Schrad.—Forest Co.: in dry open woods along Tionesta Creek from Henry's Mills to Kelletville, *17654*, det. Dix. Warren Co.: in open woods along Deerlick stream, Deerlick, *17160*, det. Dix,[6] *17165*, det. Dix.[6]

Cladonia furcata var. *racemosa* Floerke—Warren Co.: among mosses in rocky woods along Deerlick stream, Deerlick, *17131*, det. Dix, *17148*, det. Dix.

Cladonia furcata var. *racemosa* f. *furcatosubulata* (Hoffm.) Vainio—Warren Co.: on mossy boulders in woodlands, North Warren, *15462*, det. Dix.

Cladonia furcata var. *racemosa* f. *squamulifera* Sandst.—Warren Co.: in fields on hillsides, Warren, *14576*, det. Dix, det. as "*C. furcata*" by Nearing; in woodlands along Deerlick stream, Deerlick, *17140*, det. Dix.

Cladonia gracilis (L.) Willd.—Warren Co.: in open woods along Deerlick stream, Deerlick, *17137*, det. as "*C. gracilis* Willd." by Dix, who says that this is the first record of the species from the county; in woodlands, Sheffield, *17363*, det. Dix; in damp woodlands, Bull Hill, Sheffield, *17454a*, det. Dix.

Cladonia grayi G. K. Merr.—Warren Co.: in thick litter of woodlands and on logs, North Warren, *16036*, det. Dix.

Cladonia grayi f. *simplex* Robbins—Warren Co.: among mosses in moist woods along Deerlick stream, Deerlick, *17141*, det. Dix; on rotting stumps in woodlands, North Warren, *16034*, det. Dix.

Cladonia incrassata Floerke—Warren Co.: on rotting stumps and on soil mat over rotten logs in woodlands, North Warren, *16039*, det. Dix, *16047a*, det. Dix.

Cladonia macilenta Hoffm.—Warren Co.: on procumbent rotting logs in woodlands, North Warren, *16037*, det. Dix.

Cladonia nemoxyna (Ach.) Nyl.—Warren Co.: on soil of overhanging banks, North Warren, *17801*, det. Dix.

Cladonia pityrea var. *zwackhii* f. *subacuta* Vainio—Warren Co.: in open woodlands along Deerlick stream, Deerlick, *17166*, det. Dix.

Cladonia pleurota (Floerke) Schaerer—Warren Co.: on moss-covered boulders in woods, Bull Hill, Sheffield, *17738*, det. Dix.

Cladonia rangiferina Web.—Warren Co.: on moss-covered boulders in dense woods, Bull Hill, Sheffield, *17107*, det. Dix, *17750*, det. Dix.

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5 As "*C. cristatella* f. *beauvoisii* Vainio."

6 As "*C. furcata* Schrad."

Cladonia silvatica Hoffm.—Warren Co.: among mosses in woodlands, Bull Hill, Sheffield, *17108*, det. Dix.

Cladonia squamosa (Scop.) Hoffm.—Warren Co.: among moss on rocks along wood roads and on soil of overhanging banks, North Warren, *15727*, det. with a question by Dix, who says "looks like undeveloped C. *squamosa*, but it is not definite enough to base a record upon," *17798*, det. Dix; among mosses in moist open woods along Deerlick stream, Deerlick, *17147*, det. Dix;[7] *17151*, det. Dix,[7] *17162*, det. Dix;[7] on ground by mossy logs, Cranbrook Farm, North Warren, *17297*, det. Dix; on banks and in shallow humus on boulders in rocky woods between Sheffield and Brookston, *18146*, det. Dix, *18147*, det. Dix, *18155*, det. Dix, *18156*, det. Dix.

Cladonia subcariosa f. *evoluta* Vainio—Warren Co.: on rocks and stumps in woodlands, North Warren, *16035*, det. Dix.

Cladonia sylvestris G. K. Merr.—Monroe Co.: on ground, elevation about 1800 feet, Pocono Lake Preserve, *3936*, det. Lewis.

Cladonia verticillata f. *evoluta* (T. Fries) Stein—Warren Co.: on soil-mat over decaying stumps in woods, North Warren, *16038*, det. Dix; among mosses in moist woods along Deerlick stream, Deerlick, *17132*, det. as "C *verticillata* f. *evoluta* Stein" by Dix; on banks between Sheffield and Brookston, *18144*, det. Dix.

Cladonia sp.—Warren Co.: at base of trunk of *Quercus velutina*, on boulders, on soil of overhanging banks, along old wood roads, and on fallen bark in woodlands, North Warren, *15871*, det. Nearing, *17117*, *17118*, *17123*, *17125*, *17796*, *17995*; among mosses in moist open woodlands along Deerlick stream, Deerlick, *17142*, *17145*, *17149*, *17150*, *17155*, *17156*, *17157*, *17159*, *17163*; on prostate decaying logs in moist woods, Deerlick road, near Sheffield, *17262*, det. Dix; in woodlands, Sheffield, *17367*, det. Dix; on massive boulders in rocky woods between Sheffield and Brookston, *18142*, det. Dix, *18153*, det. Dix.

LECANORACEAE

Lecanora pallida (Schreb.) Schaerer—Luzerne Co.: on bark of *Fagus grandifolia*, elevation about 1200 feet, Stoddartsville, Pocono Mountains, *4082*, det. Lewis.

PARMELIACEAE

Cetraria aleurites (Ach.) T. Fries—Warren Co.: on rotting logs in woodlands, North Warren, *16046*, det. Nearing.

Cetraria ciliaris (Ach.) Tuckerm.—Luzerne Co.: on trees, elevation about 1200 feet, Stoddartsville, Pocono Mountains, *4083*, det. Lewis.

Parmelia borreri Turn.—Warren Co.: on bark of tree-trunks in woods, North Warren, *16044b*, det. Nearing.

Parmelia caperata Ach.—Warren Co.: among mosses on rocks in woods along Deerlick stream, Deerlick, *17138*, det. Dix, *17139*, det. Dix.

Parmelia conspersa (Ehrh.) Ach.—Warren Co.: on rocks of rock garden and on soil-mat over decaying stumps in woods, North Warren, *16031*, det. Nearing, *16041*, det. Nearing.

Parmelia physodes (L.) Ach.—Warren Co.: on bark of tree-trunks in woods and on rotting logs, North Warren, *16044a*, det. Nearing [erroneously cited as "14044a" on page 5 of the Observed Flora of Warren], *16045*, det. Dix; on branches and bark in woodlands along Deerlick stream, Deerlick, *17130*, det. as "*P. physodes* Ach." by Dix; on moss-covered boulders in woods, Bull Hill, Sheffield, *17751*, det. Nearing.

Parmelia rudecta Ach.—Warren Co.: on bark of maple tree-trunks, North Warren, *15994*, det. Nearing.

Parmelia saxatilis (L.) Ach.—Warren Co.: on bark of tree-trunks in woods, North Warren, *16044*, det. Nearing; on dead limbs in woodlands along Deerlick stream, Deerlick, *17168*, det. as "*P. saxatilis* Fr." by Dix.

Parmelia sulcata T. Taylor—Warren Co.: on bark of tree-trunks in woods, North Warren, *16048*, det. Nearing.

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[7] As "C. *squamosa* Hoffm."

USNEACEAE

Alectoria jubata (L.) Ach.—Monroe Co.: on spruce trees, elevation about 1800 feet, Pocono Lake Preserve, *3935*, det. as "*A. jubata* (L.) Nyl." by Lewis, so distributed, and so cited on page 7 of the Annotated List; in dark woods, Pocono Mountains, *10386*, cited as "*Bryopogon jubata* (L.) Nyl." on page 7 of the Annotated List and so distributed. Warren Co.: on rotting logs in woodlands, North Warren, *16033*, det. Dix, *16045a*, det. Dix.

Ramalina calicaris (L.) E. Fries—Monroe Co.: on bark of spruce trees, elevation about 1800 feet, Pocono Lake Preserve, *3937*, det. Lewis.

BUELLIACEAE

Rinodina sophodes (Ach.) Mass.—Warren Co.: on rocks of rock garden, North Warren, *16031a*, det. Nearing.

PHYSCIACEAE

Physcia tribacia (Ach.) Nyl.—Warren Co.: on outer bark of trunks of *Saccharodendron saccharum* and *Wallia nigra* in cultivation, North Warren, *15997*, det. Nearing, *16032*, det. Nearing.

LEPRARIACEAE

Crocynia pinkii f. *corticola* Bouly de Lesdain—Warren Co.: on bark of lower portion of *Thuja occidentalis* trunks, in cultivation, North Warren, *16007*, det. C. W. Dodge, erroneously cited as "f. *cortiloba*" on page 5 of the Observed Flora of Warren.

MARCHANTIACEAE

Conocephalum conicum (L.) Dumort.—Forest Co.: in moist woods along Tionesta Creek from Henry's Mills to Kelletville, *17653*, det. Fluford. Warren Co.: on moist soil by stream in woodlands, Cranbrook Farm, North Warren, *17289*, det. Fulford.

Marchantia polymorpha L.—Snyder Co.: in marshy ground, Selinsgrove, *4246*. Warren Co.: between bricks of roadways, on wet overhanging ledges along brooks, and on soil of forest floor in dense woodlands, North Warren, *15825*, det. Fulford, *16515*, det. Fulford, *16516*, det. Fulford, *17287*, det. Fulford, *18157*, verif. Fulford.

ANTHOCEROTACEAE

Anthoceros laevis L.—Warren Co.: on mossy stream-banks, North Warren, *15504*, det. with a question by Fulford, who says "probably *A. laevis;* the sporophytes are not quite mature, and *A. laevis* is separated from *A. punctatus* by the color and markings of the spore coat."

Anthoceros punctatus L.—Warren Co.: growing on moist bricks, North Warren, *15811*, det. Fulford, who says "very characteristic, dark, spinose spores."

JUNGERMANNIACEAE

Bazzania tricrenata (Wahlenb.) Trevis.—Warren Co.: on moss-covered boulders in woods, Bull Hill, Sheffield, *17752*, det. Steere.

Lophocolea bidentata (L.) Dumort.—Forest Co.: on floor of woods along Tionesta Creek from Henry's Mills to Kellettville, *17655*, det. Steere.

SCAPANIACEAE

Scapania undulata (L.) Dumort.—Warren Co.: on decaying logs along stream bank, Heart's Content, near Clarendon, *17702*, det. Steere.

METZGERIACEAE

Pellia epiphylla (L.) Corda—Warren Co.: on mossy logs in woods, North Warren, *15818*, det. by Fulford as "*Pellia* sp., probably *P. epiphylla*."

SPHAGNACEAE

Sphagnum acutifolium Ehrh.—Pike Co.: in bogs, Eich's Pond, *3330*, det. Lewis.

Sphagnum imbricatum var. *affine* (R. & C.) Warnst.—Warren Co.: in marshy woods, North Warren, *16357*, det. Andrews; in marsh along Deerlick stream, Deerlick, *17180*, det. Andrews; in marsh, Deerlick road, near Sheffield, *17248*, det. Andrews; in marsh, Bull Hill, Sheffield, *17748*, det. as "*S. imbricatum* in mixture" by Steere.

Sphagnum palustre L.—Pike Co.: in bogs, Eich's Pond, *3331*, det. Steere, det. as "*S. squarrosum* (Pers.) Crome" by Lewis and so distributed. Warren Co.: in marshy ground, North Warren, *16675*, det. Andrews.

DITRICHACEAE

Ditrichum pallidum (Schreb.) Hampe—Warren Co.: on clay in woods, North Warren, *15732*, det. as "*D. pallidum* (Hedw.) Hpe." by Grout; in open woods along Deerlick stream, Deerlick, *17182*, det. Grout.

DICRANACEAE

Dicranella heteromalla (L.) Schimp.—Warren Co.: on dry soil among *Maianthemum canadense* on floor of open deciduous woods, North Warren, *16506*, det. as "*D. heteromalla* (Hedw.) Schimp." by Grout; on sandy ground along Deerlick stream, Deerlick, *17187*, det. as "probably *D. heteromalla*" by Grout.

Dicranella heteromalla var. *orthocarpa* (Hedw.) E. G. Britton—Warren Co.: on clay soil along woodland roadsides, North Warren, *15731*, det. as "var. *orthocarpa* Hedw." by Grout.

Dicranella sp.—Warren Co.: in moist woodland along Deerlick stream, Deerlick, *17172*, det. as "perhaps *Dicranella*" by Grout.

Dicranum flagellare Hedw.—Pike Co.: on decayed wood in bogs, Eich's Pond, *3332*, det. Lewis. Warren Co.: on rotten wood, boulders in woodland streams, clay embankments along wood roads, and decaying logs on floor of dense deciduous woods, North Warren, *15737*, det. Grout, *16348*, det. Grout, *16349*, det. Grout, *16354*, det. Grout, *16509*, det. Grout.

Dicranum fulvum Hook.—Warren Co.: covering dry flat rock and soil adjacent to it on floor of fairly dry forest, North Warren, *16519*, det. Grout.

Dicranum scoparium (L.) Hedw.—Pike Co.: on decayed wood and in muck in bogs, Eich's Pond, *3333*, det. Steere, erroneously distributed as "*D. fulvum* Hook.," *3334*, det. Lewis. Warren Co.: forming large mats on leaf-mold and soil on forest floor in dense woodlands, North Warren, *15725*, det. Grout,[8] *16510*, det. Grout.[8]

Oncophorus polycarpus (Hedw.) Brid.—Warren Co.: on prostrate logs in woods along Deerlick stream, Deerlick, *17178*, det. Grout.

Paraleucobryum longifolium (Hedw.) Loeske—Warren Co.: on moss-covered boulders in wet woods, Bull Hill, Sheffield, *17747*, det. Steere.

Rhabdoweisia denticulata (Brid.) B. S. G.—Warren Co.: in moist woods along Deerlick stream, Deerlick, *17175*, det. Grout.

LEUCOBRYACEAE

Leucobryum glaucum (L.) Schimp.—Warren Co.: forming large colonies on damp earth in dense woodlands, North Warren, *15466*, det. as "*L. glaucum* Schimp." by Grout, *16607*; in dense woodlands, Bull Hill, Sheffield, *17105*, det. Grout; in open woods, Heart's Content, near Clarendon, *17704*, det. as "*L. glaucum* (Hedw.) Schimp." by Steere.

FUNARIACEAE

Funaria hygrometrica (L.) Sibth.—Warren Co.: on dry clay soil in woodlands and in cultivated ground, North Warren, *15487*, det. as "*F. hygrometrica* Hedw." by Grout, *15741*, det. as "probably *F. hygrometrica* Hedw." by Grout, *16222*, det. as "*F. hygrometrica* Hedw." by Grout.

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[8] As "*D. scoparium* Hedw."

Physcomitrium turbinatum (Michx.) Brid.—Warren Co.: in cultivated soil, North Warren, *16221*, det. Grout.

BRYACEAE

Bryum argenteum L.—Warren Co.: in stone pathways, North Warren, *15955*, det. as "*B. argenteum* (L.) Hedw." by Grout.

Pohlia nutans (Schreb.) Lindb.—Warren Co.: on clay soil, bark, and forest floor in dense dry woodlands, North Warren, *15671*, det. Grout, *15741a*, det. Grout, *16511*, det. as "*P. nutans* (Hedw.) Lindb." by Grout; on sandy ground near Deerlick stream, Deerlick, *17187a*, det. Grout.

Rhodobryum roseum (Weis) Limpr.—Monroe Co.: at base of *Quercus alba*, in swamp, Canadensis, Pocono Mountains, *4089*, det. as "*R. roseum* Limpr." by Steere and so cited on page 7 of the Annotated List, det. as "*Bryum roseum* Weis" by Lewis and so distributed.

MNIACEAE

Mnium affine Bland.—Forest Co.: on large boulders in woods along Tionesta Creek from Henry's Mills to Kelletville, *17657*, det. Steere. Warren Co.: on soil on floor of dry open woodlands and on forest floor near streams, North Warren, *15733*, det. Grout, *15734*, det. Grout, *16513*, det. Grout; in moist woodlands, Sheffield, *17364*, det. Steere; on moss-covered rocks and boulders in wet woods and along streams, Bull Hill, Sheffield, *17726*, det. Steere, *17746*, det. Steere.

Mnium affine var. *ciliare* (Grev.) C. Muell.—Monroe Co.: on soil or sometimes on rotten logs in woods, Swayne's Pond, *3363*, det. Lewis.

Mnium cuspidatum (L.) Leyss.—Clearfield Co.: in woods, Du Bois, *4113*, det. Steere, erroneously distributed as "*M. rostratum* Britton." Monroe Co.: on soil or sometimes on rotten logs, in woods, Buck Hill Falls, *3366*, det. Lewis. Warren Co.: on forest floor near woodland streams, on damp soil in dense woodlands, at edge of lawns, and forming dense mats with *Brotherella recurvans* in leaf-mold on floor of deciduous woods, North Warren, *15463*, det. Grout,[9] *15735*, det. Grout,[9] *16507*, det. as "*M. cuspidatum* Hedw. mainly" by Grout, *17403*, det. as "*M. cuspidatum* Hedw. (in mixture)" by Steere.

Mnium hornum L.—Forest Co.: on floor of woods along Tionesta Creek from Henry's Mills to Kelletville, *17656*, det. as "*M. hornum* Hedw." by Steere. Monroe Co.: on damp rocks along path in Lower Glen, Buck Hill Falls, *3364*, det. Lewis.

Mnium punctatum L.—Pike Co.: on stones in brook flowing out of pond, Eich's Pond, *3337*, det. Lewis, cited as "*M. punctatum* Hedw." on page 7 of the Annotated List. Warren Co.: on mossy logs in woodlands, North Warren, *15815*, det. as "*M. punctatum* Hedw." by Grout.

Mnium punctatum var. *elatum* Schimp.—Warren Co.: in woodlands, Sheffield, *17365*, det. Steere; on large humus-covered rocks along stream and forming tremendous colonies in swampy woods, Bull Hill, Sheffield, *17461*, det. Steere, *17729*, det. Steere; in leaf-mold along stream banks, Heart's Content, near Clarendon, *17705*, det. Steere.

Mnium sp.—Forest Co.: on floor of woods along Tionesta Creek from Henry's Mills to Kellettville, *17655a*, det. Steere. Warren Co.: mixed with an alga on rocks in woodland stream, North Warren, *15723*, det. Fulford.

BARTRAMIACEAE

Bartramia pomiformis (L.) Hedw.—Warren Co.: on cultivated soil, North Warren, *16197*.

Philonotis fontana (L.) Brid.—Monroe Co.: on rock walls of Catskill red shale along path in Lower Glen, Buck Hill Falls, *3355*, det. Lewis.

LESKEACEAE

Leskea polycarpa Hedw.—Warren Co.: on trunk of massive *Saccharodendron saccharum* tree, North Warren, *15998*, det. Grout.

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9 As "*M. cuspidatum* Leyss."

THUIDIACEAE

Thuidium delicatulum (L.) Mitt.—Forest Co.: on large boulders in woods along Tionesta Creek from Henry's Mills to Kellettville, *17658*, det. Steere.[10] Monroe Co.: on Catskill conglomerate boulders, Lower Falls, *3341*, det. Steere, erroneously distributed as "*Hylocomium proliferum* (L.) Lindb." Pike Co.: on rotten logs in damp shady woods, Eich's Pond, *3335*, det. Lewis. Warren Co.: on rotten logs in woodlands and on mossy boulders by streams, North Warren, *15461*, det. Grout,[10] *16049*, det. Grout,[10] *16094*, det. Grout;[10] in moist woods along Deerlick stream, Deerlick, *17179*, det. Grout; on large humus-covered rocks along stream, Bull Hill, Sheffield, *17728*, det. Steere.[10]

Thuidium minutulum (Hedw.) B. S. G.—Monroe Co.: on stones in woods, Lower Levis Falls, *3343*, det. Steere, erroneously distributed as "*Hypnum reptile* Michx."

AMBLYSTEGIACEAE

Amblystegium varium (Hedw.) Lindb.—Warren Co.: on moist bricks, North Warren, *15810*, det. Grout.

Calliergon cordifolium (Hedw.) Kindb.—Warren Co.: on boulders in woodland streams, North Warren, *16352*, det. Grout; in mud on bank of stream, Heart's Content, near Clarendon, *17706*, det. Steere.

Calliergonella schreberi (Willd.) Grout—Monroe Co.: on rocks, Spruce Cabin Falls, Barrett Township, *3362*, det. as "*Calliergon schreberi* Willd." by Lewis. Potter Co.: in bogs, Eulalie Township, *16213*, det. Andrews. Warren Co.: in dense moist woods, Bull Hill, Sheffield, *17106*, det. Grout, *17113*, det. Grout; in moist woodlands along Deerlick stream, Deerlick, *17174*, det. Grout.

Hygroamblystegium irriguum (Wils.) Leske—Warren Co.: on boulders in woodland streams, North Warren, *16351*, det. Grout, *16355*, det. Grout.

HYPNACEAE

Brotherella delicatula (James) Fleisch.—Warren Co.: on procumbent logs in woods, North Warren, *15740*, det. Grout.

Brotherella recurvans (Michx.) Fleisch.—Monroe Co.: on decayed logs in woods, Lower Levis Falls, *3344*, det. as "*Hypnum recurvans* (Michx.) Schwaegr." by Lewis and so distributed. Warren Co.: forming dense mats with *Mnium cuspidatum* in leaf-mold on floor of open deciduous woods, North Warren, *16508*, det. Grout; on large boulders and prostrate logs in woods, Bull Hill, Sheffield, *17112*, det. Grout, *17749*, det. Steere.

Heterophyllium haldanianum (Grev.) Kindb.—Pike Co.: on decayed logs in woods, Eich's Pond, *3336*, det. Lewis. Warren Co.: on clay soil in woods, on forest floor, and on rocks along woodland roads, North Warren, *15729*, det. Grout, *15730*, det. Grout, *15742*, det. Grout; on soil over decayed logs along stream bank, Heart's Content, near Clarendon, *17703*, det. Steere.

Hypnum imponens Hedw.—Monroe Co.: on rotten wood in bogs, Lower Levis Falls, *3342*, det. Lewis. Warren Co.: on boulders, damp soil in dense woodlands, procumbent logs near woodland streams, rotting stumps, and forming large mats over flat rocks and adjacent decaying limbs on floor of moist forests, North Warren, *15465*, det. Grout, *15728*, det. Grout, *15739*, det. Grout, *15813*, det. Grout, *16095*, det. Grout, *16356*, det. Grout, *16505*, det. Grout, *16520*, det. Grout; on decaying logs in moist woodlands, Bull Hill, Sheffield, *17110a*, det. Grout, *17114*, det. Grout; on prostrate logs in moist woods along Deerlick stream, Deerlick, *17183*, det. Grout.

Hypnum patientiae Lindb.—Warren Co.: in moist woods along Deerlick stream, Deerlick, *17184*, det. Grout.

Hypnum reptile Michx.—Warren Co.: in moist woods along Deerlick stream, Deerlick, *17177*, det. Grout, *17188*, det. Grout.

Ptilium crista-castrensis (L.) De Not.—Monroe Co.: on pebbly gray Catskill

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10 As "*T. delicatulum* (Hedw.) Mitt."

sandstone boulder on Boulder Trail along Buck Hill Creek, Buck Hill Falls, *3328*, det. Lewis.

PLAGIOTHECIACEAE

Plagiothecium denticulatum (L.) B. S. G.—Clearfield Co.: in woods, Du Bois, *4412*, det. Lewis, cited as "*P. denticulatum* (L.) B. & S." on page 8 of the Annotated List and so distributed. Warren Co.: on forest floor near stream, North Warren, *15736*, det. as "*P. denticulatum* (Hedw.) Bry. Eur." by Grout; in moist woods, fruiting, along Deerlick stream, Deerlick, *17189*, det. Grout.

Plagiothecium laetum B. S. G.—Warren Co.: on mossy logs and on soil of forest floor in open fairly dry woodlands, North Warren, *15184*, det. Grout, *16518*, det. as "*P. laetum* Bry. Eur. mainly, mixed" by Grout.

Plagiothecium turfaceum Lindb.—Warren Co.: on boulders in woodland streams, North Warren, *16350*, det. Grout; in moist woods, sterile, along Deerlick stream, Deerlick, *17189a*, det. Grout.

BRACHYTHECIACEAE

Brachythecium rivulare B. S. G.—Warren Co.: on boulders in woodland streams, North Warren, *16353*, det. Grout.

Brachythecium rutabulum (Hedw.) B. S. G.—Warren Co.: on rocks in rock garden, North Warren, *16098*, det. Grout.

Bryhnia novae-angliae (Sull. & Lesq.) Grout—Warren Co.: on mossy boulders in woodlands, North Warren, *15464*, det. Grout, who says "shade form approaching *B. graminicolor* (Brid.) Grout;" on large humus-covered rocks by streams, Bull Hill, Sheffield, *17727*, det. Steere.

Eurhynchium serrulatum (Hedw.) Kindb.—Warren Co.: on prostrate logs and on stones in dense woodlands, North Warren, *15738*, det. Grout, *15869*, det. Grout; in moist woodlands along Deerlick stream, Deerlick, *17171*, det. Grout; on decaying logs in moist woods, Bull Hill, Sheffield, *17467*, det. Steere.

HEDWIGIACEAE

Hedwigia albicans (Webb.) Lindb.—Pike Co.: on gray sandstone boulder of Catskill age in woods, Eich's Pond, *3340*, det. Lewis, erroneously cited as "*H. albicans* (Webb.) Lindl." on page 8 of the Annotated List.

FONTINALACEAE

Fontinalis antipyretica var. *gigantea* Sulliv.—Monroe Co.: submerged at inlet, Swayne's Pond, Buck Hill Falls, *3346*, det. Lewis.

Fontinalis dalecarlica B. S. G.—Monroe Co.: submerged at inlet, Swayne's Pond, Buck Hill Falls, *3347*, det. Lewis, inaccurately cited as "*3346*" and "*F. dalecarlica* B. & S." on page 8 of the Annotated List and so distributed.

CLIMACIACEAE

Climacium americanum Brid.—Monroe Co.: in swampy ground near Broodhead Creek, Bon Hill, Buck Hill Falls, *3365*, det. Lewis. Warren Co.: in dense moist woods along woodland brook, Cranbrook Farm, North Warren, *17307*, det. Andrews, *17315*, det. Andrews.

Climacium dendroides (L.) Web. & Mohr—Warren Co.: in marsh, Deerlick road, near Sheffield, *17247*, det. Andrews.

POLYTRICHACEAE

Atrichum angustatum (Brid.) B. S. G.—Warren Co.: on forest floor, North Warren, *15721*, det. as "*A. angustatum* (Brid.) Bry. Eur." by Grout.

Atrichum undulatum (L.) P. Beauv.—Warren Co.: on clay soil along edge of woods, North Warren, *15722*, det. as "*A. undulatum* (Hedw.) P. B." by Grout.

Pogonatum brevicaule (Brid.) P. Beauv.—Fayette Co.: in woodlands, Connellsville, *3563*, det. Lewis.

Pogonatum pensilvanicum (Hedw.) Paris—Warren Co.: in clay soil on roadside bank in woods, North Warren, *15812*, det. Grout.

Polytrichum commune L.—Monroe Co.: in woods near Margaret Falls, Buck Hill Falls, *3329*, det. Steere, det. as "*P. ohioense* R. & C." by Lewis and so distributed. Warren Co.: forming carpets in dense woodlands and on clay-loam along wood roads, North Warren, *15724*, det. as "*Polytrichum*, probably *P. commune*" by Grout, *15853*, det. as "*P. commune* Hedw." by Grout; on decaying logs and on soil in moist woodlands, Bull Hill, Sheffield, *17110*, det. Grout, *17114a*, det. Grout.

Polytrichum commune var. *uliginosum* L.—Pike Co.: in bogs, Eich's Pond, *3338*, det. Lewis.

Polytrichum juniperinum Willd.—Potter Co.: in damp wods, Coudersport, *17539*, det. as "*P. juniperinum* Hedw." by Steere. Warren Co.: in open woodlands, Bull Hill, Sheffield, *17109*, det. Grout, *17111*, det. Grout; in moist open woodlands along Deerlick stream, Deerlick, *17169*, det. Grout, *17173*, det. Grout.

Polytrichum ohioense R. & C.—Warren Co.: on soil of floor of dense dry woodlands, North Warren, *15533*, det. Grout, *16512*, det. Grout.

Polytrichum piliferum Schreb.—Warren Co.: in moist woodlands along Deerlick stream, Deerlick, *17170*, det. Grout.

GEORGIACEAE

Tetraphis pellucida Hedw.—Pike Co.: on prostrate decayed tree-trunks in boggy woods, Eich's Pond, *3339*, det. as "*Georgia pellucida* Rabesch," by Lewis and so distributed. Warren Co.: on decaying logs in dense moist woodlands, North Warren, *16517*, det. Grout; on prostrate logs in moist woods along Deerlick stream, Deerlick, *17176*, det. Grout, *17185*, det. Grout, *17186*, det. Grout; in woodlands, Sheffield, *17366*, det. Steere.

OPHIOGLOSSACEAE

Botrychium dissectum Spreng.—Warren Co.: in woodlands, North Warren, *15800*.

Botrychium neglectum Wood—Monroe Co.: in moist shady woodlands, Buck Hill Falls, *2521*, det. Lewis. Warren Co.: in moist woodlands, North Warren, *15854*.

Botrychium obliquum Muhl.—Warren Co.: in dense woodlands, North Warren, *15673*; in dense woods along Four Mile Creek, *18059*.

Osmundopteris virginiana (L.) Small—Cumberland Co.: in moist woodlands on mountainside, Boiling Springs, *1997*, distributed as "*Botrychium virginianum* (L.) Sw." Warren Co.: in dense damp woodlands, North Warren, *15570*, *16597*; in moist woods, Deerlick road, near Sheffield, *16318*; in dense woods, Sheffield, *17346*; in deep woods between Irvington and Tideoute, *17522*.

CYATHEACEAE

Cibotium schiedei Cham. & Schlecht.—Lackawanna Co.: in greenhouse cultivation, Scranton, *4238*.

POLYPODIACEAE

Adiantum cuneatum Langsd. & Fisch.—Lackawanna Co.: in greenhouse cultivation, Scranton, *4241*. Warren Co.: in indoor cultivation, North Warren, *15128*, verif. Bailey.

Adiantum pedatum L.—Potter Co.: in damp woods, Coudersport, *17536*. Warren Co.: in dense woodlands, North Warren, *15579*; in woodlands, Deerlick, near Sheffield, *16312*; in deep damp woods between Irvington and Tideoute, *17481*.

Anchistea virginica (L.) Presl—Warren Co.: in marshy ground, Bear Lake, *18208*.

Asplenium trichomanes L.—Snyder Co.: in rocky cliffs along roadside at Blue Hill, Shamokin Dam, *2754*, det. Lewis.

Athyrium angustum (Willd.) Presl—Monroe Co.: in woods along stream, Buck Hill Falls, *2972*, det. as "*A. filix-foemina* (L.) Roth" by Lewis and so distributed. Warren Co.: in dense damp rocky woodlands and along margins of wood roads, North Warren, *15385*, *16429*, *16474*; in damp woods along Conewango Creek between

North Warren and Russell, *17571;* in open woods, Sandstone Springs, *17613;* in dense damp woodlands, Chandler's Valley, *17827;* in dense woods near Brookston, *18012.*

Athyrium angustum var. *elatius* (Link) Butters—Warren Co.: in moist dense woodlands, North Warren, *15577, 16473, 16794;* in dense damp woodlands, Chandler's Valley, *17824.*

Camptosorus rhizophyllus (L.) Link—Monroe Co.: on large moist rocks in shaded woodlands, Buck Hill Falls, *2702,* det. Lewis.

Cyrtomium falcatum (L. f.) Presl—Snyder Co.: in indoor cultivation, Selinsgrove, *3136.* Warren Co.: in indoor cultivation, North Warren, *14711,* verif. Bailey, inaccurately cited as "C. *falcatum* (Sw.) Presl" on page 6 of the Observed Flora of Warren.

Cystopteris fragilis (L.) Bernh.—Monroe Co.: among moist rocks in woodlands, Buck Hill Falls, *3001,* det. Lewis.

Dennstaedtia punctilobula (Michx.) Moore—Monroe Co.: in more or less moist soil on open hillside, Buck Hill Falls, *2671,* det. Lewis. Potter Co.: large colonies in fields, Coudersport, *16404.* Warren Co.: on railroad embankments, Warren, *14815;* on embankments in woods, Deerlick, near Sheffield, *16309;* in fields, woodlands, and thickets along margins of woods, North Warren, *16464, 16628, 16671,* det. Monachino; in woodlands, Sandstone Springs, *17614;* in woodlands, Bull Hill, Sheffield, *17720.*

Diplazium acrostichoides (Sw.) Butters—Monroe Co.: in moist woodlands, Buck Hill Falls, *2670,* det. as "*Athyrium thelypteroides* (Michx.) Desv." by Lewis and so distributed.

Dryopteris cristata (L.) A. Gray—Warren Co.: in deep woods, Chandler's Valley, *17817.*

Dryopteris filix-mas (L.) Schott—Monroe Co.: in wood garden at summer home of Mrs. George W. Stratton, Buck Hill Falls, *2973,* det. Lewis.

Dryopteris goldiana (Hook.) A. Gray—Monroe Co.: in rock garden of Mrs. George W. Stratton, Buck Hill Falls, *3077,* det. Lewis, incorrectly cited as "*D. goldiana* (Hassk.) A. Gray" on page 9 of the Annotated List and so distributed.

Dryopteris intermedia (Muhl.) A. Gray—Forest Co.: in dense woods along Tionesta Creek from Henry's Mills to Kelletville, *17640.* Monroe Co.: in moist woodlands, Buck Hill Falls, *2672,* det. Lewis. Potter Co.: in woodlands, Coudersport, *16294.* Warren Co.: in open woods and in dense damp rocky woodlands, North Warren, *16240, 16475, 16596, 16672;* in moist woods, Deerlick, near Sheffield, *16319;* in leafmold covering decaying logs in woods, Bull Hill, Sheffield, *17463, 17464, 17465;* in dense woods between Irvington and Tideoute, *17484, 17496;* in deep woods between Sheffield and Blue Jay, along the Tionesta Creek, *17588;* in woodlands between North Warren and Russell, *17889;* in dense woods near Brookston, *18006, 18018.*

Dryopteris linnaeana C. Chr.—Monroe Co.: in moist woodlands, Buck Hill Falls, *2673,* det. Lewis.

Dryopteris marginalis (L.) A. Gray—Forest Co.: in dense woods along Tionesta Creek from Henry's Mills to Kelletville, *17639.* Monroe Co.: in rocky woodlands, Buck Hill Falls, *2674,* det. Lewis. Warren Co.: in dense damp woods and rocky woodlands, North Warren, *15576, 16477, 16595;* in woodlands between North Warren and Russell, *17890.*

Dryopteris spinulosa (O. F. Muell.) Kuntze—Warren Co.: on and among boulders in dense woods, North Warren, *15155.*

Elaphoglossum crinitum Christ—Lackawanna Co.: in indoor cultivation, Scranton, *4243.*

Nephrolepis exaltata var. *bostoniensis* Davenport—Warren Co.: in indoor cultivation, North Warren, *15517,* verif. Bailey.

Nephrolepis exaltata var. *bostoniensis* f. *craigi* Benedict—Warren Co.: in indoor cultivation, North Warren, *16446,* verif. Bailey.

Nephrolepis exaltata var. *bostoniensis* f. *cristata* Benedict—Warren Co.: in indoor cultivation, North Warren, *16125,* verif. Bailey.

Nephrolepis exaltata var. *bostoniensis* f. *goodi* Benedict—Warren Co.: in indoor cultivation, North Warren, *16448,* verif. Bailey.

Nephrolepis exaltata var. *bostoniensis* f. *magnifica* Benedict—Warren Co.: in indoor cultivation, North Warren, *16447*, verif. Bailey.

Nephrolepis exaltata var. *bostoniensis* f. *whitmanii* Barrows—Warren Co.: in indoor cultivation, North Warren, *15080*, verif. Bailey, *16126*, verif. Bailey, *16449*, verif. Bailey.

Onoclea sensibilis L.—Potter Co.: in marshes and moist swales and in outdoor cultivation, Coudersport, *16291*, *16402*. Warren Co.: in marshes about 2 miles west of Warren, *15167*; in marshy ground along Conewango Creek, North Warren, *15532*.

Onoclea sensibilis f. *obtusilobata* (Schk.) Gilbert—Warren Co.: with the normal form in moist soil at edge of woodlands, North Warren, *15611*.

Onychium japonicum Kunze—Potter Co.: in indoor cultivation, Coudersport, *16159*.

Pellaea atropurpurea (L.) Link—Snyder Co.: on moist cliffs, Shamokin Dam, *2742*, det. Lewis.

Phegopteris hexagonoptera (Michx.) Fée—Forest Co.: in open woods along Tionesta Creek from Henry's Mills to Kellettville, *17651*. Monroe Co.: in rocky wood garden of Mrs. George W. Stratton, Buck Hill Falls, *3016*, det. as "*Dryopteris hexagonoptera* (Michx.) C. Chr." by Lewis and so distributed. Warren Co.: in dense damp rocky woods, North Warren, *16480*; in dense woods between Irvington and Tideoute, *17483*.

Phegopteris polypodioides Fée—Monroe Co.: in moist woodlands, Buck Hill Falls, *2676*, det. as "*Dryopteris phegopteris* (L.) C. Chr." by Lewis and so distributed. Warren Co.: in damp woods, North Warren, *16241*.

Phlebodium aureum (L.) J. E. Sm.—Lackawanna Co.: in indoor cultivation, Scranton, *4240*, distributed as "*Polypodium aureum* L."

Platycerium bifurcatum C. Chr.—Warren Co.: in indoor cultivation, Warren, *14484*, verif. Bailey.

Polypodium virginianum L.—Monroe Co.: on moist mossy cliffs, Buck Hill Falls, *2677*, det. as "*P. vulgare* L." by Lewis and so distributed. Warren Co.: on massive boulders in dark woods near Kinzua, *17221*; on massive boulders between Sheffield and Blue Jay, along the Tionesta Creek, *17587*.

Polystichum acrostichoides (Michx.) Schott—Warren Co.: in damp woods on hillsides, Warren, *14765*; in dense woodlands, North Warren, *15443*.

Polystichum acrostichoides f. *incisum* (A. Gray) Gilbert—Warren Co.: in dense woods between Irvington and Tideoute, *17485*, det. Weatherby.

Polystichum braunii (Spenner) Fée—Monroe Co.: in rocky wood garden of Mrs. George W. Stratton, Buck Hill Falls, *3078*, det. Lewis.

Polystichum tsussimense J. Sm.—Lackawanna Co.: in indoor cultivation, Scranton, *4213*.

Pteretis pensylvanica (Willd.) Fernald—Snyder Co.: in outdoor cultivation, Selinsgrove, *3201*, cited as "*Matteuccia struthiopteris* (L.) Todaro" on page 9 of the Annotated List and so distributed. Warren Co.: in wet woods and in outdoor cultivation, North Warren, *15644*, verif. Bailey; in damp woodlands, Deerlick, near Sheffield, *16323*; in marshy soil along woodland streams, Sandstone Springs, *17610*; in dense damp woodlands by stream, Chandler's Valley, *17825*; in moist woodlands near Brookston, *18015*. Numbers *15644*, *16323*, and *16792* were cited as "*P. nodulosa* (Michx.) Nieuwl." on page 7 of the Observed Flora of Warren and page 3 of its first supplement, and no. *15644* was so distributed.

Pteridium latiusculum (Desv.) Hieron.—Potter Co.: in open woods, Coudersport, *17528*. Warren Co.: in open woodlands and along margins of woods, North Warren, *15200*, *15362*, *16594*; in open woods, Sandstone Springs, *17606*, *17607*, *17609*. Often infested with *Cryptomyces pteridis*. Numbers *17528*, *17606*, *17607*, and *17609* were det. as "*P. aquilinum* (L.) Kuhn var. *latiusculum* (Desv.) Underw. ex Heller" by Weatherby.

Pteridium latiusculum f. *berdii* Moldenke—Warren Co.: in dense woods, often mixed with the typical form, but in large numbers, North Warren, *16476*, *16593* (type); in open woods, Sandstone Springs, *17604*, *17605*. Often infested with *Cryptomyces pteridis*. The last two collections were det. as "*P. aquilinum* (L.) Kuhn var. *latiusculum* (Desv.) Underw. ex Heller" by Weatherby.

Pteris serrulata L. f.—Warren Co.: in indoor cultivation, Warren, *14485*, det. as "*P. multifida* Poir." by Clausen.

Pteris serrulata var. *cristata* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *16120*, verif. Bailey.

Pteris tremula R. Br.—Lackawanna Co.: in indoor cultivation, Scranton, *4239*.

Thelypteris dentata (Forsk.) E. St. John—Lackawanna Co.: in indoor cultivation, Scranton, *4242*, distributed as "*Dryopteris dentata* (Forsk.) C. Chr."

Thelypteris noveboracensis (L.) Nieuwl.—Monroe Co.: in moist woodlands, Buck Hill Falls, *2675*, det. as "*Dryopteris noveboracensis* (L.) A. Gray" by Lewis and so distributed. Warren Co.: in marshes and moist woodlands, North Warren, *14684*, *15534*; in woods near Sheffield, *16330*; in dense woodlands between Irvington and Tideoute, *17482*; in open woods, Sandstone Springs, *17611*; in dense woods near Brookston, *18019*.

Woodsia ilvensis (L.) R. Br.—Monroe Co.: on moist exposed cliffs, Buck Hill Falls, *2678*, det. Lewis.

Woodsia obtusa (Spreng.) Torr.—Snyder Co.: among moist rocks at north end of the Narrows, Selinsgrove, *3829*.

OSMUNDACEAE

Osmunda cinnamomea L.—Cumberland Co.: in moist woodlands on mountainside, Boiling Springs, *1996*. Warren Co.: in moist woodlands, North Warren, *15535*; in moist woodlands near stream between Irvington and Tideoute, *17487*; in marshy woodlands, Sandstone Springs, *17602*, *17608*, *17616*.

Osmunda claytoniana L.—Potter Co.: in woods, Coudersport, *16296*. Snyder Co.: in outdoor cultivation and in woodlands along streams, Selinsgrove, *2407*. Warren Co.: in outdoor cultivation, North Warren, *14736*, verif. Bailey.

Osmunda spectabilis Willd.—Monroe Co.: in moist woods, Buck Hill Falls, *2908*, det. as "*O. regalis* L." by Lewis and so distributed. Warren Co.: in cinders along railroad embankment, Deerlick, near Sheffield, *16311*.

EQUISETACEAE

Equisetum arvense L.—Potter Co.: in sphagnum bog, Eulalia Township, *16214*; in marshy places, Coudersport, *16272*. Snyder Co.: along edge of highway near Bake Oven Hill, Selinsgrove, *2317*. Warren Co.: on railroad embankments and roadside banks, North Warren, *14675*, *15389*; roadsides, along Deerlick stream, Deerlick, *17129*.

Equisetum fluviatile L. Snyder Co.: in marsh along canal-bed at the Cut, Selinsgrove, *2491*.

Equisetum sylvaticum L.—Warren Co.: in marshy ground, Chandler's Valley, *17820*.

Hippochaete praealta (Raf.) Farwell—Warren Co.: in large colonies in marsh east of Russell, *16845*.

LYCOPODIACEAE

Lycopodium clavatum L.—Potter Co.: in woods, Austin, *17544*. Warren Co.: in woodlands, Warren, *14548*; in dense woodlands at border of Forest County between Henry's Mills and Blue Jay, *17101*; in dense woods, Deerlick road, near Sheffield, *17278*.

Lycopodium flabelliforme (Fernald) Blanchard—Warren Co.: in woods, Warren, *14547*; in woods, Deerlick, near Sheffield, *16324*; in dense woodlands at border of Forest County between Henry's Mills and Blue Jay, *17102*; in deep woods between Sheffield and Brookston, *18129*.

Lycopodium lucidulum Michx.—Snyder Co.: in dark moist woodlands, Selinsgrove, *2649*. Warren Co.: forming large colonies in moist dense woodlands, North Warren, *14591*, *15677*.

Lycopodium obscurum L.—Snyder Co.: in woods on top of ridge, Salem, *2752*. Warren Co.: among leaf-mold in dense woods, North Warren, *14611*, *15444*; in woodlands near Sheffield, *16326*; in woodlands at border of Forest County between Henry's Mills and Blue Jay, *17100*; in deep woods between Sheffield and Brookston, *18132*.

SELAGINELLACEAE

Selaginella kraussiana A. Br.—Philadelphia Co.: in indoor cultivation, Philadelphia, *3066*. Warren Co.: indoor cultivation, North Warren, *14561*, det. Clausen.

Selaginella uncinata Spreng.—Lackawanna Co.: in indoor cultivation, Scranton, *4219*.

CYCADACEAE

Cycas revoluta Thunb.—Snyder Co.: in indoor cultivation, Selinsgrove, *2801*.

GINKGOACEAE

Ginkgo biloba L.—Warren Co.: in outdoor cultivation, North Warren, *16461*, verif. Bailey.

Ginkgo biloba var. *fastigiata* Henry—Snyder Co.: in outdoor cultivation, Selinsgrove, *2492*, distributed as "*G. biloba* L." and so cited on page 11 of the Annotated List. Warren Co.: in outdoor cultivation, North Warren, *15619*, verif. Bailey.

TAXACEAE

Taxus baccata f. *nana* (Rehd.) E. H. Wils.—Warren Co.: in outdoor cultivation, North Warren, *17442*, det. Rehder.

Taxus baccata var. *repandens* Parsons—Warren Co.: in outdoor cultivation, North Warren, *15150*, det. as "*T. baccata* var." by Rehder.

Taxus baccata var. *stricta* Laws.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3850*, cited as "var. *fastigiata* Loud." on page 11 of the Annotated List and so distributed.

Taxus canadensis Marsh.—Northumberland Co.: on sheltered banks along road to Kneass, Herndon, *2783*.

ARAUCARIACEAE

Araucaria excelsa R. Br.—Lackawanna Co.: in indoor cultivation, Scranton, *4232*. Warren Co.: in indoor cultivation, North Warren, *16020*, verif. Bailey.

PINACEAE

Abies balsamea (L.) Mill.—Warren Co.: in outdoor cultivation, North Warren, *15520*, det. Rehder.

Abies concolor (Gord.) Engelm.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3819*, cited as "*A. concolor* Lindl. & Gord." on page 11 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *14476*, det. Rehder.

Larix decidua Mill.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2464*, distributed as "*L. europaea* DC."

Larix decidua var. *pendula* (Laws.) Henk. & Hochst.—Warren Co.: in outdoor cultivation, Warren, *14578*, verif. Bailey.

Larix laricina (Du Roi) K. Koch—Warren Co.: cultivated and naturalized on watershed, North Warren, *14588*, verif. Bailey.

Picea abies (L.) K. Karst.—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *2803*, distributed as "*P. excelsa* Link." Warren Co.: in extensive outdoor cultivation and seedlings naturalized, North Warren, *15073*, verif. Bailey.

Picea pungens var. *argentea* Rosenthal—Snyder Co.: in outdoor cultivation, Selinsgrove, *2473*, cited as "var. *kosteri* Beissn." on page 11 of the Annotated List and so distributed.

Picea pungens var. *glauca* Regel—Warren Co.: in outdoor cultivation, North Warren, *15525*, verif. Bailey.

Picea rubens Sarg.—Monroe Co.: in woods along trail, Buck Hill Falls, *2986*, cited as "*P. rubra* Lam." on page 12 of the Annotated List and so distributed.

Pinus echinata Mill.—Dauphin Co.: in open woods at edge of field, Lykens, *2238*.

Pinus mugo Turra—Warren Co.: in outdoor cultivation, North Warren, *15140*, verif. Bailey, *17339*.

Pinus nigra Arnold—Warren Co.: in outdoor cultivation, North Warren, *14696*, verif. Bailey.

Pinus pungens Lamb.—Snyder Co.: in woods, Selinsgrove, *3828*.

Pinus resinosa Ait.—Snyder Co.: in woods, Selinsgrove, *3098*. Warren Co.: in outdoor cultivation and naturalized on watershed, North Warren, *15251*, verif. Rehder, *15300*, verif. Rehder.

Pinus rigida Mill.—Snyder Co.: in woods on steep bank of Penn's Creek, Penn Avon, *2363*. Warren Co.: in reforestation project on hillside, North Warren, *16102*, verif. Bailey.

Pinus sylvestris L.—Perry Co.: in outdoor cultivation and escaped, Blain, *2782*. Warren Co.: in reforestation projects, in outdoor cultivation, and naturalized along side of wood road, North Warren, *15299*, verif. Bailey, *15779*.

Pinus thunbergii Parl.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3150*.

Pinus virginiana Mill.—Snyder Co.: in woods on crest of Bake Oven Hill, Selinsgrove, *2796*.

Pseudotsuga taxifolia (Poir.) N. L. Britton—Warren Co.: in outdoor cultivation, North Warren, *17441*, det. Rehder.

Strobus weymouthiana Opiz—Warren Co.: in woods and in outdoor cultivation, North Warren, *14596*, verif. Bailey, *14752*.

Tsuga canadensis (L.) Carr.—Snyder Co.: in woods along edge of Penn's Creek, Selinsgrove, *2421*. Warren Co.: in outdoor cultivation and scattered in woods, on hillsides, and in ravines, North Warren, *15298*, verif. Bailey.

Tsuga canadensis var. *pendula* Beissn.—Warren Co.: in outdoor cultivation, Warren, *14572*, verif. Bailey.

CUPRESSACEAE

Juniperus communis L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2293*.

Juniperus communis var. *saxatilis* Pall.—Warren Co.: in outdoor cultivation, North Warren, *14592*, verif. Bailey, *16200*, verif. Bailey.

Sabina chinensis var. *pfitzeriana* (Spaeth) Moldenke—Snyder Co.: in outdoor cultivation, Selinsgrove, *3874*, cited as "*Juniperus chinensis* var. *pfitzeriana* Spalth" on page 13 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *16186*, verif. Bailey.

Sabina horizontalis f. *plumosa* (Rehd.) Moldenke—Warren Co.: in outdoor cultivation, North Warren, *17338*.

Sabina officinalis Garcke—Warren Co.: in outdoor cultivation, North Warren, *17340*.

Sabina virginiana (L.) Antoine—Snyder Co.: along hedgerows, fencerows, and roadsides, Selinsgrove, *2383*, cited as "*Juniperus virginiana* L." on page 13 of the Annotated List and so distributed.

Thuja occidentalis L.—Warren Co.: in outdoor cultivation, North Warren, *14466*, det. Bailey.

Thuja occidentalis var. *fastigiata* Jaeg.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2435*, cited as "*T. occidentalis* L." on page 13 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, Warren, *14571*, verif. Bailey.

Thuja occidentalis var. *lutea* Kent—Snyder Co.: in outdoor cultivation, Selinsgrove, *3877*, cited as "var. *lutea* Veitch" on page 13 of the Annotated List and so distributed.

Thuja occidentalis var. *spiralis* Hort.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3875*.

Thuja orientalis var. *stricta* Loud.—Warren Co.: in indoor and outdoor cultivation, North Warren, *15090*, verif. Bailey.

MAGNOLIACEAE

Liriodendron tulipifera L.—Snyder Co.: in woodlands and in outdoor cultivation, Selinsgrove, *2451*. Warren Co.: in woods and in outdoor cultivation, North Warren, *15092*, verif. Bailey.

Magnolia soulangiana Soul.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2294*, cited as "*M. soulangeana* Soul." on page 32 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *15218*, det. Rehder.

Tulipastrum acuminatum (L.) Small—Somerset Co.: in woods, Davidsville, *3870*, cited as "*Magnolia acuminata* L." on page 32 of the Annotated List and so distributed. Warren Co.: in woods along edge of old road, North Warren, *15367*.

ANNONACEAE

Asimina triloba (L.) Dunal—Snyder Co.: along bank of Penn's Creek at Hoover's Landing, Selinsgrove, *2437*.

LAURACEAE

Benzoin aestivale (L.) Nees—Warren Co.: in thickets, ravines, and margins of woods, North Warren, *15372*, *18112*.

Cinnamomum cassia (Nees) Blume—Lackawanna Co.: in indoor cultivation, Scranton, *4228*, cited as "*C. cassia* Blume" on page 32 of the Annotated List and so distributed.

Cinnamomum zeylanicum Blume—Philadelphia Co.: in indoor cultivation, Philadelphia, *3063*.

Laurus nobilis L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14725*, verif. Bailey.

Persea americana Mill.—Warren Co.: in indoor cultivation, North Warren, *16143*, verif. Bailey.

Sassafras albidum (Nutt.) Nees — Clinton Co.: along fencerows northwest of Hammersley Fork, *17549*.

Sassafras albidum var. *molle* (Raf.) Fernald—Snyder Co.: along fencerows and at edge of woods, Selinsgrove, *2316*, *2476*. Warren Co.: along margins of wood roads and borders of woods, North Warren, *15387*. The first two of these collections were distributed as "*S. variifolium* (Salisb.) Kuntze."

RANUNCULACEAE

Aconitum fischeri Reichenb.—Warren Co.: in outdoor cultivation, North Warren, *18224*.

Actaea pachypoda Ell.—Potter Co.: in woodlands, Coudersport, *16686*. Warren Co.: in dense woodlands, North Warren, *15430*.

Anemone canadensis L.—Warren Co.: in moist meadows and along fencerows, North Warren, *15283*, *16359*; in grassy meadows between Irvington and Tideoute, *17495*; in grassy meadows along Conewango Creek between North Warren and Russell, *17566*.

Anemone cylindrica A. Gray—Forest Co.: in open woods along Tionesta Creek from Henry's Mills to Kelletville, *17624*. Warren Co.: in woodlands and along margins of wood roads, North Warren, *15478*, *16761*; in grassy meadows between Irvington and Tideoute, *17523*.

Anemone japonica Sieb. & Zucc.—Warren Co.: in outdoor cultivation, North Warren, *15986*, verif. Bailey.

Anemone japonica var. *alba* Huftelen—Warren Co.: in outdoor cultivation, North Warren, *15985*, verif. Bailey, cited as "var. *alba* J. B. Keller" on page 8 of the Observed Flora of Warren and so distributed.

Anemone nemorosa L.—Warren Co.: in outdoor cultivation, North Warren, *16196*, verif. Bailey.

Anemone quinquefolia L.—Snyder Co.: in woods along trolley-tracks, Selinsgrove, *2321*. Warren Co.: in moist woods, Warren, *14508*; in dense moist woodlands, North Warren, *14584*; in hollow in field on hillside, flowers pink, Sheffield, *17378*.

Anemonella thalictroides (L.) Spach—Warren Co.: in woodlands, Warren, *14507*; in woodlands, North Warren, *16216*; in dense woods near Kinzua, *17238*.

Anemonella thalictroides f. *rosea* (Millsp.) Moldenke—Warren Co.: in dense woods, North Warren, *17122*.

Aquilegia caerulea James—Warren Co.: in outdoor cultivation, North Warren, *14905*, verif. Bailey.

Aquilegia canadensis L.—Potter Co.: in woodlands, Coudersport, *16293*. Snyder Co.: on rocky cliffs along steep edge of Middle Creek, Selinsgrove, *2328*. Warren Co.:

among rocks along margins of wood roads and in outdoor cultivation, North Warren, *15689*, *16263*, verif. Bailey.

Aquilegia chrysantha A. Gray—Warren Co.: in outdoor cultivation, North Warren, *14903*, verif. Bailey.

Aquilegia vulgaris L.—Potter Co.: escaped along fences, Coudersport, *16281*. Warren Co.: escaped from cultivation, Warren, *14532;* in outdoor cultivation and escaped in waste ground and roadways, North Warren, *14824*, verif. Bailey.

Aquilegia vulgaris var. *nivea* Baumg.—Warren Co.: in outdoor cultivation, North Warren, *14902*, verif. Bailey.

Aquilegia vulgaris f. *pleniflora* Moldenke—Potter Co.: naturalized along fences, Coudersport, *16280*. Warren Co.: in outdoor cultivation, North Warren, *14844*, verif. Bailey.

Atragene americana Sims—Snyder Co.: climbing over shrubs in rocky woodlands, Middleburg, *3830*.

Caltha palustris L.—Snyder Co.: in marshy ground, Mount Pleasant Mills, *2287*, erroneously cited under the *Araceae* on page 24 of the Annotated List. Warren Co.: in marshy ground, Warren, *14502;* in marshes, wet fields, and along streams, North Warren, *14585*.

Cimicifuga racemosa (L.) Nutt.—Forest Co.: in open woods along Tionesta Creek from Henry's Mills to Kelletville, *17637*. Warren Co.: at margins of woods, North Warren, *15363*, *16478;* at border of woodland, Warren, *16711*.

Clematis paniculata Thunb.—Warren Co.: in outdoor cultivation, North Warren *15954*, verif. Bailey.

Clematis virginiana L.—Potter Co.: climbing over shrubs at edge of thickets, Coudersport, *16566*. Warren Co.: climbing over shrubs in hedgerows, in thickets, and at borders of woods, North Warren, *15260*, *15710*, 16539, *16770;* clambering over shrubs along fencerows, Sheffield, *17856*.

Coptis groenlandica (Oeder) Fernald—Warren Co.: in leaf-mold on floor of dense woods, North Warren, *15669;* in dense woods, Deerlick road, near Sheffield, *17279*.

Delphinium ajacis L.—Warren Co.: in outdoor cultivation and abundantly escaped as weed in waste and cultivated ground, North Warren, *14713*, verif. Bailey, *18225*.

Delphinium cheilanthum var. *formosum* Huth—Warren Co.: in outdoor cultivation, North Warren, *15765*, det. Bailey, inaccurately cited as "*D. cheilanthus* var. *formosum*" on page 8 of the Observed Flora of Warren.

Delphinium cultorum Voss—Warren Co.: in outdoor cultivation, North Warren, *15021*, verif. Bailey, *15767*, verif. Bailey.

Helleborus viridis L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2271*.

Hepatica acutiloba P. DC.—Monroe Co.: in woods, Buck Hill Falls, *2997*, cited as "*H. acuta* (Pursh) Britton" on page 33 of the Annotated List. Potter Co.: in open woods, Coudersport, *16287*. Warren Co.: in woodlands and in greenhouse cultivation, North Warren, *17203*.

Hepatica americana (P. DC.) Ker—Snyder Co.: on sunny mountain-slopes, Selinsgrove, *2255*, cited as "*H. americana* Ker" on page 33 of the Annotated List and so distributed. Warren Co.: on hillsides in woods, Warren, *14495;* in leaf-mold in dense woodlands, North Warren, *15480*.

Paeonia albiflora Pallas—Warren Co.: in outdoor cultivation, North Warren, *14937*, verif. Bailey.

Paeonia albiflora f. *pleniflora* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *14924*, verif. Bailey, *14925* (type), verif. Bailey.

Paeonia albiflora var. *sinensis* Steud.—Warren Co.: in outdoor cultivation, North Warren, *16256*, verif. Bailey.

Paeonia suffruticosa H. C. Andr.—Warren Co.: in outdoor cultivation, North Warren, *15297*, verif. Bailey.

Ranunculus abortivus L.—Snyder Co.: in waste ground, ditches, and along roadsides, Selinsgrove, *2289*. Warren Co.: in moist ditches and along roadsides, North Warren, *14782*, verif. Benson; in moist ditches near Kinzua, *17224;* in waste ground and ditches, Sheffield, *17360*.

Ranunculus acris L.—Warren Co.: in grassy meadows and fields, North Warren, *14676*, verif. Benson; in meadows, Sheffield, *17362*.

Ranunculus asiaticus L.—Snyder Co.: in outdoor cultivation, Salem, *3192*.

Ranunculus hispidus Michx.—Warren Co.: in dense woods, North Warren, *17119*.

Ranunculus recurvatus Poir.—Snyder Co.: on mountain road by Aqueduct Hollow, Selinsgrove, *2426*. Warren Co.: along small woodland streams, North Warren, *15432*, verif. Benson.

Ranunculus repens L.—Warren Co.: in outdoor cultivation and widely naturalized in lawns and ditches, North Warren, *14892*, verif. Benson.

Ranunculus repens var. *pleniflorus* Fernald—Synder Co.: escaped from cultivation and naturalized in moist ditches along roadsides, Selinsgrove, *2425*, cited as "var. *floreplenus* P. DC." on page 34 of the Annotated List.

Ranunculus septentrionalis Poir.—Snyder Co.: in moist canal-bed, Selinsgrove, *2312*. Warren Co.: in meadows and marshes, Warren, *14512*, verif. Benson; in marshes near Kinzua, *17233*; in marshes, Deerlick road, near Sheffield, *17267*.

Thalictrum coriaceum (N. L. Britton) Small—Warren Co.: in meadows between Irvington and Tideoute, *17494*.

Thalictrum dioicum L.—Snyder Co.: on rocky ledges, Selinsgrove, *2802*. Warren Co.: on banks along wood roads, Warren, *14788*; in dense woods and in outdoor cultivation, North Warren, *17200*; in woodlands, Sheffield, *17377*.

Thalictrum polygamum Muhl.—Warren Co.: in moist meadows about 2 miles west of Warren, *15162*; in marshes and along streams, North Warren, *15209*.

Viticella deltoidea Moench—Snyder Co.: in outdoor cultivation, Selinsgrove, *3220*, distributed as "*Clematis viticella* L."

Viticella jackmani (Van Houtte) Moldenke—Snyder Co.: in outdoor cultivation, Selinsgrove, *2453*, distributed as "*Clematis jackmanii* Moore." Warren Co.: in outdoor cultivation, North Warren, *15146*, verif. Bailey.

NYMPHAEACEAE

Nuphar advena Ait.—Forest Co.: in stagnant water along Tionesta Creek from Henry's Mills to Kelletville, *17630*. Snyder Co.: in swampy pond along old canal-bed, Selinsgrove, *1991*, distributed as "*N. advena* R. Br." and cited as "*Nymphozanthus advena* (Ait.) Fernald" on page 34 of the Annotated List.

BERBERIDACEAE

Berberis thunbergii P. DC.—Snyder Co.: in outdoor cultivation and widely escaped, Selinsgrove, *2323*. Warren Co.: in extensive outdoor cultivation and naturalized as weed in waste and cultivated ground, Warren, *14560*, verif. Bailey.

Berberis thunbergii var. *atropurpurea* Chenault—Warren Co.: in outdoor cultivation, North Warren, *17192*.

Berberis vulgaris L.—Warren Co.: in outdoor cultivation, Warren, *14580*, verif. Bailey; in outdoor cultivation and tending to escape, North Warren, *14744*, verif. Bailey.

Berberis vulgaris f. *atropurpurea* Regel—Warren Co.: in outdoor cultivation, North Warren, *14612*, verif. Bailey.

Berberis vulgaris f. *cyanocarpa* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *16115* (type), verif. Bailey.

Mahonia aquifolium (Pursh) Nutt.—Warren Co.: in outdoor cultivation and tending to become weedy, North Warren, *16026*, verif. Bailey.

PODOPHYLLACEAE

Caulophyllum thalictroides (L.) Michx.—Snyder Co.: in damp hemlock woods on steep bank of Middle Creek, Selinsgrove, *2799*. Warren Co.: in woodlands, North Warren, *17206*.

Jeffersonia diphylla (L.) Pers.—Monroe Co.: in wood garden of Mrs. George W. Stratton, Buck Hill Falls, *3005*.

Podophyllum peltatum L.—Snyder Co.: in moist woodlands, Selinsgrove, *2358*. Warren Co.: in woods and along old wood roads, Warren, *14814*.

ARISTOLOCHIACEAE

Aristolochia durior Hill—Snyder Co.: in outdoor cultivation, Selinsgrove, *2431*, distributed as "*A sipho* L'Hér." and cited as "*A. macrophylla* Lam." on page 35 of the Annotated List. Warren Co.: in outdoor cultivation and escaped, North Warren, *15761*, verif. Bailey.

Asarum canadense L.—Snyder Co.: in moist woods, Selinsgrove, *2404*. Warren Co.: in dense dark woodlands, North Warren, *15667*.

Hexastylis shuttleworthii (J. Britten) Small—Monroe Co.: in wood garden of Mrs. George W. Stratton, Buck Hill Falls, *3004*, distributed as "*Asarum shuttleworthi* Britton & Baker."

PIPERACEAE

Peperomia floridana Small—Potter Co.: in indoor cultivation, Coudersport, *16163*. Warren Co.: in indoor cultivation, Warren, *14567*, verif. Trelease.

Peperomia floridana var. *aurea* Trelease—Warren Co.: in indoor cultivation, North Warren, *16192*, verif. Bailey.

Peperomia sandersii var. *argyreia* L. H. Bailey—Lackawanna Co.: in indoor cultivation, Scranton, *4224*. Warren Co.: in indoor cultivation, North Warren, *15227*, verif. Bailey.

PAPAVERACEAE

Chelidonium majus L.—Snyder Co.: in waste ground near Bake Oven Hill, Selinsgrove, *2322*. Warren Co.: in outdoor cultivation and widely naturalized along sides of buildings, in hedgerows, on dumps, in ditches, and along fencerows, North Warren, *14666*, *17390*.

Eschscholzia californica Cham.—Warren Co.: in outdoor cultivation, North Warren, *15638*, verif. Bailey.

Macleaya cordata (Willd.) R. Br.—Warren Co.: in outdoor cultivation and escaping as a weed along fences and in cultivated ground, North Warren, *15253*, verif. Bailey.

Papaver nudicaule L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *15086*, verif. Bailey.

Papaver orientale L.—Warren Co.: in outdoor cultivation, Warren, *14840*, verif. Bailey.

Papaver rhoeas L.—Warren Co.: in outdoor cultivation and escaped, North Warren, *16443*, verif. Bailey.

Papaver somniferum L.—Warren Co.: in outdoor cultivation, tending to become weedy, North Warren, *15122*, verif. Bailey.

Papaver somniferum f. *fimbriatum* (W. Mill.) Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15161*, verif. Bailey.

Sanguinaria canadensis L.—Warren Co.: in moist woods, Warren, *14498*.

FUMARIACEAE

Adlumia fungosa (Ait.) Greene—Snyder Co.: in waste ground, Selinsgrove, *2463*.

Corydalis aurea Willd.—Snyder Co.: along dry roadsides, Port Treverton, *1981*.

Corydalis flavula Raf.—Snyder Co.: in waste ground at edge of woods, Selinsgrove, *2455*.

Corydalis sempervirens (L.) Pers.—Forest Co.: in hedgerows along Tionesta Creek from Henry's Mills to Kelletville, *17643*. Snyder Co.: on rocky banks of Middle Creek, Selinsgrove, *2839*.

Dicentra canadensis (Goldie) Walp.—Potter Co.: in damp woods, Coudersport, *16288*. Warren Co.: in moist woods, Warren, *14509*; in woodlands, North Warren, *14687*.

Dicentra cucullaria (L.) Bernh.—Potter Co.: in woods, Coudersport, *16285*. Snyder Co.: in dark damp woods along old canal-bed, Selinsgrove, *2270*.

Dicentra spectabilis Lem.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2336*. Warren Co.: in outdoor cultivation, North Warren, *15100*, verif. Bailey.

LOASACEAE

Mentzelia lindleyi T. & G.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16298*, verif. Bailey.

BRASSICACEAE

Alyssum alyssoides L.—Snyder Co.: in dry fields, Salem, *3191*.

Alyssum saxatile L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3184*. Warren Co.: in outdoor and in greenhouse cultivation, Warren, *14569*.

Arabidopsis thaliana (L.) N. L. Britton—Snyder Co.: in waste ground and roadside banks, Selinsgrove, *2819*.

Arabis dentata T. & G.—Warren Co.: in thickets, Sheffield, *17375*; in waste ground near barnyard and in woods, North Warren, *17388*.

Arabis laevigata (Muhl.) Poir.—Forest Co.: in open woods along Tionesta Creek from Henry's Mills to Kelletville, *17625*. Snyder Co.: on dry cliffs near Hoover's Landing, Selinsgrove, *2319*, *2438*. Warren Co.: in dense woodlands, North Warren, *15586*; in dense woodlands near Kinzua, *17229*.

Arabis lyrata L.—Snyder Co.: on rocky cliffs at edge of Middle Creek, Selinsgrove, *2797*.

Armoracia lapathifolia Gilib.—Snyder Co.: in outdoor cultivation and escaped in waste ground and along roadsides on Isle of Que, Selinsgrove, *2859*, cited as "*A. rusticana* Gaertn., Mey. & Scherb." on page 36 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation and widely escaped along roadsides and in muddy banks of Allegheny River, Warren, *14809*; in outdoor cultivation and escaped along roadsides, North Warren, *17404*.

Aubrietia deltoidea var. *olympica* Nichols.—Warren Co.: in indoor and outdoor cultivation, Warren, *14827*, verif. Bailey.

Berteroa incana (L.) P. DC.—Potter Co.: in fields and pastures, Coudersport, *16728*.

Brassica caulorapa Pasq.—Warren Co.: in outdoor cultivation, North Warren, *15632*, verif. Bailey, *15992*.

Brassica hirta Moench—Warren Co.: weed in greenhouse pots and benches and in waste ground and compost piles, Warren, *14832*; in cultivated ground, North Warren, *18094*.

Brassica juncea (L.) Cosson—Snyder Co.: along roadsides, Selinsgrove, *3827*.

Brassica kaber var. *pinnatifida* (Stokes) Wheeler—Potter Co.: in waste and cultivated ground, Coudersport, *17537*. Snyder Co.: in waste ground along Susquehanna River, Selinsgrove, *3862*, distributed as "*B. arvensis* (L.) B. S. P." and cited as "*Sinapis arvensis* L." on page 38 of the Annotated List. Warren Co.: in waste ground, North Warren, *14873*, *15313*, *17064*, *17733*.

Brassica nigra (L.) K. Koch—Warren Co.: in waste soil and abandoned fields along roadsides, Warren, *15337*.

Brassica oleracea var. *botrytis* L.—Warren Co.: in outdoor cultivation, North Warren, *15807*.

Brassica oleracea var. *capitata* L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3866*. Warren Co.: in outdoor cultivation, North Warren, *15651*.

Brassica oleracea var. *italica* Plenck—Warren Co.: in outdoor cultivation, North Warren, *16654*, verif. Bailey.

Brassica pekinensis Rupr.—Schuylkill Co.: in outdoor cultivation, Tamaqua, *11829*. Warren Co.: in outdoor cultivation, North Warren, *15808*, *15987*, det. Bailey.

Brassica rapa L.—Warren Co.: in fields as weed and also in outdoor cultivation, North Warren, *14874*, verif. Bailey, *15805*, verif. Bailey, *17391*.

Camelina microcarpa Andrz.—Snyder Co.: in dry fields, Penn Avon, *2843*, distributed as "*C. microcarpa* (L.) Crantz."

Camelina sativa (L.) Crantz—Snyder Co.: in dry fields, Selinsgrove, *4355*.

Campe barbarea (L.) W. F. Wight—Potter Co.: in dry fields, Coudersport, *17532*. Warren Co.: in grassy fields, North Warren, *14680*; in pastures and fields, Warren, *14783*.

Capsella bursa-pastoris (L.) Medic.—Snyder Co.: in lawns, grassy fields, waste and cultivated ground, Selinsgrove, *2320*. Warren Co.: in roadways and gardens, Warren, *14554*.

Cardamine bulbosa (Schreb.) B. S. P.—Snyder Co.: in moist springy ground on Isle of Que, Selinsgrove, *2307*. Warren Co.: in moist woods, Warren, *14500;* in springy meadows and moist woodlands, North Warren, *14589*, *17393;* in meadows along stream, near Kinzua, *17220*.

Cardamine flexuosa With.—Warren Co.: in woodlands between Irvington and Tideoute, *17498*, det. Rollins.

Cardamine parviflora L.—Snyder Co.: in waste ground, Selinsgrove, *4295*.

Cardamine pensylvanica Muhl.—Snyder Co.: on small island in Middle Creek, Selinsgrove, *3172*, cited as "*C. pennsylvanica*" on page 37 of the Annotated List and so distributed. Warren Co.: in wet banks and along wood roads, Warren, *14773;* along wood roads, North Warren, *15486;* in marshy ground near Kinzua, *17239;* along streams, Deerlick road, near Sheffield, *17281*.

Cardamine pratensis var. *palustris* Wimm. & Grab.—Warren Co.: in marshes and swamps, North Warren, *14617;* in marsh near Kinzua, *17235;* in moist swale, Cranbrook Farm, North Warren, *17327*.

Cardamine rotundifolia Michx.—Warren Co.: in small stream, Deerlick road, near Sheffield, *17277*.

Cardamine sp.—Warren Co.: in woodland between Irvington and Tideoute, *17498*.

Cheiranthus cheiri L.—Warren Co.: in indoor cultivation, North Warren, *16107*, verif. Bailey.

Cheirinia aspera (P. DC.) N. L. Britton—Warren Co.: in outdoor cultivation, North Warren, *14758*, det. as "*Erysimum asperum*, DC." by Bailey.

Cheirinia cheiranthoides (L.) Link—Snyder Co.: in dry soil, Selinsgrove, *3227*, distributed as "*Erysimum cheiranthoides* L."

Dentaria diphylla Michx.—Warren Co.: in moist woods, Warren, *14523;* in marshes and along brooks, North Warren, *14685;* in moist swale along Deerlick stream, Deerlick, *17126*.

Dentaria laciniata Muhl.—Snyder Co.: in moist ground along banks of Middle Creek, Selinsgrove, *2308*. Warren Co.: in moist woods, Warren, *14505;* in woodlands, North Warren, *17208*.

Hesperis matronalis L.—Potter Co.: at edge of stream and in waste ground along roadsides, Coudersport, *16269*, *16387*. Snyder Co.: in outdoor cultivation, Selinsgrove, *2827*. Warren Co.: along hedgerows, Warren, *14777;* in outdoor cultivation and widely naturalized along roadsides, on dumps, and in meadows near Conewango Creek, North Warren, *15151*, *15424*, *17396*.

Iberis sempervirens L.—Warren Co.: in outdoor cultivation, North Warren, *16205*, verif. Bailey.

Iberis umbellata L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *14828*, verif. Bailey.

Lepidium campestre (L.) R. Br.—Snyder Co.: in dry overgrown fields, Penn Avon, *2833*. Warren Co.: in grassy fields and ditches, Warren, *14802;* in dry fields, Cranbrook Farm, North Warren, *17296*.

Lepidium virginicum L.—Snyder Co.: in waste ground and along roadsides, Selinsgrove, *2828*. Warren Co.: in fields, ditches, and waste ground, North Warren, *14936*, *17805*.

Lobularia maritima (Lam.) Desv.—Warren Co.: in indoor and outdoor cultivation, Warren, *14559*, verif. Bailey.

Lobularia maritima f. *gigantea* L. H. Bailey—Warren Co.: in greenhouse cultivation, North Warren, *17336*.

Lobularia maritima f. *lilacina* Moldenke — Warren Co.: in indoor and outdoor cultivation, North Warren, *14954*, verif. Bailey.

Lobularia maritima f. *purpurea* Moldenke—Warren Co.: in indoor and outdoor cultivation, North Warren, *16142*, verif. Bailey.

Lunaria annua L.—Warren Co.: in outdoor cultivation, North Warren, *14738*, det. Bailey, *15143*, verif. Bailey.

Mathiola incana R. Br.—Lackawanna Co.: in outdoor cultivation, Scranton, *4248*, cited as "*Matthiola incana*" on page 37 of the Annotated List.

Mathiola incana var. *annua* Voss—Warren Co.: in greenhouse cultivation, North Warren, *14855*, verif. Bailey, *16189*, det. as "*Erysimum?*" by Bailey.

Mathiola incana f. *pleniflora* Moldenke—Warren Co.: in indoor cultivation, North Warren, *14722* (type), verif. Bailey.

Nasturtium officinale R. Br.—Potter Co.: in brooks, Coudersport, *16409*. Snyder Co.: in water of spring along road from Selinsgrove to Penn Avon, *2750*, cited as "*Sisymbrium nasturtium-aquaticum* L." on page 38 of the Annotated List and so distributed. Warren Co.: along margins of woodland streams, North Warren, *15681*; in marshes, Chandler's Valley, *17821*.

Raphanus raphanistrum L.—Lackawanna Co.: in waste ground and fields, Scranton, *6504*.

Raphanus sativus L. — Warren Co.: in indoor and outdoor cultivation, North Warren, *15627*, verif. Bailey; in waste ground, Deerlick road, Sheffield, *17714*.

Rorippa islandica var. *microcarpa* (Regel) Fernald—Warren Co.: in dry fields between Irvington and Tideoute, *17474*; in marshy ground, Deerlick road, Sheffield, *17717*; in marshy ground along Conewango Creek, North Warren, *17828*.

Rorippa sylvestris (L.) Bess.—Warren Co.: in moist ditches and in marshy ground on island in Conewango Creek, North Warren, *16647*, *18093*; in marsh, Deerlick road, Sheffield, *17713*.

Sisymbrium officinale (L.) Scop.—Snyder Co.: in waste ground and along hedges, Selinsgrove, *2829*, cited as "*Erysimum officinale* L." on page 37 of the Annotated List.

Sisymbrium officinale var. *leiocarpum* P. DC.—Warren Co.: in waste ground and fields, North Warren, *14967*, *16604*, *17808*.

Sisymbrium sp.—Warren Co.: in grassy meadow, Sheffield, *16526*, det. Rollins.

Thlaspi arvense L.—Warren Co.: in waste and cultivated ground, North Warren, *16524*.

VIOLACEAE

Viola blanda Willd.—Snyder Co.: in moist woods along old canal-bed on Isle of Que, Selinsgrove, *2301*. Warren Co.: in marshy ground, Sheffield, *17345*.

Viola canadensis L.—Clearfield Co.: in rich woods, Ott's Run, *14494*. Warren Co.: in woodlands, North Warren, *16628*; in woods, Cranbrook Farm, North Warren, *17332*.

Viola conspersa Reichenb.—Snyder Co.: in moist thickets, Shamokin Dam, *2331*; in fields, Mount Pleasant Mills, *3194*. Warren Co.: in dense woodlands, especially near streams, North Warren, *14586*, *15591*, *15687*, *17385*; in woodlands east of Russell, *16844*; in moist woods, Deerlick road, near Sheffield, *17286*.

Viola cucullata Ait.—Snyder Co.: in moist soil of dark swampy woods, Selinsgove, *3154*; Warren Co.: in marshes, Deerlick road, near Sheffield, *17284*.

Viola emarginata (Nutt.) Le Conte—Snyder Co.: in woods, Tall Timbers State Park, Troxelville, *3845*. Warren Co.: on banks along wood roads, Warren, *14767*.

Viola eriocarpa Schwein.—Snyder Co.: in evergreen woods along Middle Creek, Selinsgrove, *3823*. Warren Co.: in woodlands, North Warren, *14679*; in woods, Cranbrook Farm, North Warren, *17331*.

Viola eriocarpa f. *leiocarpa* (Fernald & Wiegand) Deam—Warren Co.: in dense woodlands, North Warren, *15686*.

Viola incognita var. *forbesii* Brainerd—Warren Co.: in moist dense woodlands, North Warren, *14590*, *16245*; in moist woods along Deerlick stream, Deerlick, *17127*.

Viola kitaibeliana var. *rafinesquii* (Greene) Fernald—Snyder Co.: on grassy banks along roadside, Penn Avon, *3152*, cited as "*V. rafinesquii* Greene" on page 38 of the Annotated List and so distributed.

Viola odorata L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16002*, verif. Bailey.

Viola odorata f. **plena** Moldenke, f. nov.—Haec varietas a forma typica speciei corollis plenis recedit. This form differs from the typical form of the species in its more or less full-doubled corollas. The type (no. *3130*) was collected in indoor cultivation at Selinsgrove, Snyder Co., Pennsylvania, on March 25, 1927, and is

deposited in the Britton Herbarium at the New York Botanical Garden. It was distributed as "*V. odorata* var. *florepleno* Hort." and cited on page 38 of the Annotated List as "*V. odorata* var. *plena* Hort."

Viola pallens (Banks) Brainerd—Snyder Co.: in moist woods, Tall Timbers State Park, Troxelville, *3844*.

Viola palmata L.—Snyder Co.: along edge of woodlands, Port Treverton, *3162*.

Viola papilionacea Pursh—Snyder Co.: in fields and moist meadows, Selinsgrove, *3176*. Warren Co.: in meadows and fields and in outdoor cultivation, North Warren, *14609, 14682, 17202*.

Viola pedata var. *linearíloba* P. DC.—Snyder Co.: in dry sunny evergreen woods on hill slope, Penn Avon, *3141*.

Viola pubescens Ait.—Warren Co.: in woods on hillside, Warren, *14499;* in dense woods near Kinzua, *17222;* in woods near Sheffield, *17414*.

Viola rostrata Pursh—Warren Co.: in woods on shaded hillsides, Warren, *14524;* in woodlands, North Warren, *16227;* in dense woods, Sheffield, *17355*.

Viola rotundifolia Michx.—Potter Co.: in damp woods, Coudersport, *16286*. Warren Co.: in moist dense woodlands, North Warren, *14583, 15676;* in dense woods along Deerlick stream, Deerlick, *17128*.

Viola sagittata Ait.—Snyder Co.: along roadsides, Selinsgrove, *2396*.

Viola sagittata var. *ovata* (Nutt.) T. & G.—Snyder Co.: along railroad tracks, Selinsgrove, *2292*, cited as "*V. fimbriatula* J. E. Sm." on page 38 of the Annotated List and so distributed.

Viola selkirkii Pursh—Warren Co.: in moist woods, Warren, *14496*.

Viola septentrionalis Greene—Snyder Co.: in woods along dirt road to Tall Timbers State Park, Troxelville, *3843*. Warren Co.: in moist woods, Warren, *14510;* in woodlands, North Warren, *16246, 17197, 17407;* in woods, Cranbrook Farm, North Warren, *17333*.

Viola striata Ait.—Snyder Co.: in woods along roadside, Selinsgrove, *2283*. Warren Co.: in moist woods, Warren, *14503;* along small brook near Kinzua, *17232*.

Viola tricolor L.—Snyder Co.: in outdoor cultivation, tending to escape, Selinsgrove, *3169*.

Viola tricolor var. *hortensis* P. DC.—Warren Co.: in indoor and outdoor cultivation, North Warren, *14731*, verif. Bailey.

Viola triloba Schwein.—Snyder Co.: in moist woods, Selinsgrove, *3852*. Warren Co.: in deep woods, North Warren, *15590;* in woodlands, Sheffield, *17351*.

RESEDACEAE

Reseda odorata L.—Warren Co.: in indoor cultivation, Warren, *14558*, verif. Bailey.

Reseda odorata var. *grandiflora* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *17337*.

POLYGALACEAE

Polygala sanguinea L.—Warren Co.: in clearings in open woodlands, North Warren, *15817;* in grassy fields one mile southwest of Sheffield, *17012;* in grassy fields, Willow Street Run, Sheffield, *18114*.

Polygala senega L.—Warren Co.: in woodlands, Warren, *14808*.

Polygala verticillata var. *isocycla* Fernald—Warren Co.: in dry soil on banks at margins of woodland roads, North Warren, *15484*.

Triclisperma paucifolia (Willd.) Nieuwl.—Snyder Co.: along margins of woods on hillside, Penn Avon, *2834*, distributed as "*Polygala paucifolia* Willd." Warren Co.: in light woods, thickets, and on banks along old wood roads, Warren, *14513, 14770;* in dense woodlands, North Warren, *15470;* in dense thickets, Cranbrook Farm, North Warren, *17326*.

CRASSULACEAE

Aeonium arboreum (L.) Webb. & Berth.—Warren Co.: in indoor cultivation, North Warren, *16139*, det. Alexander.

Bryophyllum pinnatum Kurz—Warren Co.: in indoor cultivation, North Warren, *14931*, verif. Bailey.

Crassula argentea Thunb.—Warren Co.: in indoor cultivation, Warren, *14465*, det. Clausen; in indoor cultivation, North Warren, *16096*, verif. Bailey, *17073*, det. Clausen.

Crassula lycopodioides Lam.—Warren Co.: in indoor cultivation, Warren, *14462*, det. Clausen.

Crassula marginalis Soland.—Warren Co.: in indoor cultivation, Warren, *14464*, det. Clausen.

Crassula portulacea Lam.—Lackawanna Co.: in indoor cultivation, Scranton, *4227*.

Crassula tetragona L.—Warren Co.: in indoor cultivation, North Warren, *16164*, det. Alexander.

Echeveria gibbiflora var. *metallica* (Lem.) J. G. Baker—Warren Co.: in indoor cultivation, North Warren, *15248*, det. Clausen.

Echeveria glauca J. G. Baker—Lackawanna Co.: in indoor cultivation, Scranton, *4226*.

Echeveria pumila Van Houtte—Warren Co.: in indoor cultivation, North Warren, *16138*, det. Alexander.

Echeveria secunda (J. G. Baker) Booth—Warren Co.: in indoor cultivation, North Warren, *15067*, det. Bailey, *16005*, verif. Bailey but questioned by Clausen.

Graptopetalum paraguayense (N. E. Br.) E. Walther—Warren Co.: in indoor cultivation, North Warren, *16131*, det. Clausen.

Kalanchoë blossfeldiana Poellnitz—Warren Co.: in indoor cultivation, Warren, *14461*, det. Clausen.

Kalanchoë daigremontiana Hamet & Perrier—Warren Co.: in indoor cultivation, North Warren, *16108*, det. Clausen.

Kalanchoë fedtschenkoi Hamet & Perrier—Warren Co.: in indoor cultivation, North Warren, *14706*, det. Clausen, *16104*, det. Clausen.

Kalanchoë verticillata Ell.—Warren Co.: in indoor cultivation, North Warren, *16029*, det. Clausen.

Sedum acre L.—Monroe Co.: in outdoor cultivation and abundantly escaped, Buck Hill Falls, *2984*.

Sedum adolphii Hamet—Warrren Co.: in indoor cultivation, North Warren, *16141*, det. Clausen, *17072*, det. Clausen.

Sedum album L.—Warren Co.: in outdoor cultivation and escaping in waste places, North Warren, *17754*, verif. Clausen.

Sedum amecamecanum Praeger—Warren Co.: in indoor cultivation, North Warren, *16165*, det. Alexander.

Sedum mexicanum N. L. Britton—Warren Co.: in indoor cultivation, Warren, *14487*, det. Clausen.

Sedum mite Gilib.—Warren Co.: in outdoor cultivation and escaping in waste places, North Warren, *17755*, det. Clausen.

Sedum pachyphyllum Rose—Warren Co.: in indoor cultivation, North Warren, *16103*, det. Clausen.

Sedum praealtum A. DC.—Warren Co.: in indoor cultivation, North Warren, *16140*, det. Alexander.

Sedum reflexum L.—Snyder Co.: in outdoor cultivation and escaping, Selinsgrove, *2342*.

Sedum sarmentosum Bunge—Warren Co.: in indoor and outdoor cultivation and tending to escape, North Warren, *14999*, verif. Bailey, *16202*, verif. Bailey.

Sedum spectabile Boreau—Warren Co.: in outdoor cultivation and tending to become weedy, North Warren, *16795*, det. Bailey.

Sedum spurium Bieb.—Warren Co.: in outdoor cultivation and escaping in waste places, North Warren, *16234*, verif. Bailey, *17753*, verif. Clausen.

Sedum stahlii Solms — Warren Co.: in indoor cultivation, becoming weedy in greenhouse benches, North Warren, *16136*, det. Alexander.

Sedum ternatum Michx.—Dauphin Co.: along roadsides, Millersburg, *2362*. Warren Co.: escaped along fencerow near old garden, Sheffield, *17382*, det. Clausen.

Sedum triphyllum (Haw.) S. F. Gray —Warren Co.: in moist ditches, hedgerows, orchards, and grassy hillsides, North Warren, *15196*, *16775*.

Sedum sp.—Warren Co.: in indoor cultivation, North Warren, *16166*, det. Alexander, who says "near *S. oaxacanum* Rose, but not it."

PENTHORACEAE

Penthorum sedoides L.—Clinton Co.: in wet ditches, Lock Haven, *3542*. Warren Co.: in marshes and moist ditches, North Warren, *16706*, *16785*.

SAXIFRAGACEAE

Chrysosplenium americanum Schwein.—Warren Co.: in wet roadways through dense woodlands and along small streams, North Warren, *15674*; in small stream between North Warren and Russell, *17244*.

Heuchera curtisii T. & G.—Perry Co.: in rocky cliffs along roadside, Liverpool, *2480*.

Heuchera sanguinea Engelm.—Warren Co.: in indoor cultivation, North Warren, *17091*.

Micranthes pensylvanica (L.) Haw.—Snyder Co.: in moist meadows, Penn Avon, *3155*, cited as "*M. pennsylvanica*" on page 40 of the Annotated List and so distributed. Warren Co.: in marshy ground, Chandler's Valley, *17819*.

Micranthes virginiensis (Michx.) Small—Snyder Co.: on cliffs and sunny hilltops, Penn Avon, *2280*. Warren Co.: in sunny locations on hillsides, Warren, *14520*.

Mitella diphylla L.—Columbia Co.: in woodlands south of Bloomsburg, *2352*. Warren Co.: in sunny openings in woods on damp hillsides, Warren, *14527*, *14764*; in dense woods, Deerlick road, near Sheffield, *17275*.

Saxifraga sarmentosa L.—Lackawanna Co.: in indoor cultivation, Scranton, *4225*. Warren Co.: in indoor cultivation, North Warren, *16753*, verif. Bailey.

Tiarella cordifolia L.—Lycoming Co.: in rich moist woodlands, Williamsport, *3179*. Warren Co.: in sunny spots in woodlands, Jackson Run, *14490*; in woodlands, North Warren, *14683*; in dense woods between North Warren and Russell, *17242*; in dense woods, Deerlick road, near Sheffield, *17276*.

DROSERACEAE

Drosera rotundifolia L.—Centre Co.: in swamps at Bear Meadows, Tusseyville, *2485*.

SARRACENIACEAE

Sarracenia purpurea L.—Centre Co.: in swamps at Bear Meadows, Tusseyville, *2486*.

CARYOPHYLLACEAE

Agrostemma githago L.—Snyder Co.: in wheat and other grain fields, Selinsgrove, *2497*.

Dianthus allwoodii L. H. Bailey—Warren Co.: in indoor and outdoor cultivation, North Warren, *14909*, det. as "Hortulan pink, probably cross of *D. plumarius* and *D. caryophyllus*" by Bailey.

Dianthus armeria L.—Warren Co.: in dry grassy fields, waste ground, and margins of wood roads, North Warren, *15261*, *15802*, *16428*, *17925*.

Dianthus barbatus L.—Warren Co.: in outdoor cultivation and escaped along fences and roadsides, North Warren, *14971*, verif. Bailey, *15712*; naturalized in grassy field about 2 miles west of Warren, *15171*.

Dianthus caryophyllus var. *longicaulis* L. H. Bailey—Warren Co.: in indoor and summer outdoor cultivation, Warren, *14539*, verif. Bailey.

Dianthus deltoides L.—Warren Co.: in outdoor cultivation, North Warren, *15101*, det. Bailey, *16265*, verif. Bailey; naturalized in dry fields between Irvington and Tideoute, *17475*.

Dianthus latifolius Willd.—Warren Co.: in outdoor cultivation, North Warren, *15827*, det. Bailey.

Dianthus plumarius L.—Warren Co.: in outdoor cultivation, North Warren, *16299*, verif. Bailey.

Gypsophila elegans Bieb.—Warren Co.: in indoor cultivation, North Warren, *16436*, verif. Bailey.

Gypsophila paniculata L.—Bedford Co.: in outdoor cultivation, Bedford Springs, *3320*. Warren Co.: in outdoor cultivation, North Warren, *15621*, verif. Bailey.

Lychnis alba Mill.—Potter Co.: in fields, Coudersport, *16279*. Snyder Co.: in dry fields and along roadsides south of Selinsgrove, *2414*. Warren Co.: abundant in waste and cultivated ground and fields and in moist ground along Conewango Creek, North Warren, *14759*, *16380*.

Lychnis chalcedonica L.—Monroe Co.: naturalized along roadsides, Tannersville, *8684*. Warren Co.: in outdoor cultivation and escaped, North Warren, *15017*, verif. Bailey.

Lychnis flos-cuculi L.—Snyder Co.: abundant in grassy fields, Rolling Green, *3203*.

Lychnis viscaria L.—Warren Co.: in outdoor cultivation, North Warren, *14901*, verif. Bailey.

Saponaria officinalis L.—Warren Co.: along railroad embankments, roadsides, and fencerows, Warren, *15333*; in grassy roadside ditches, along fencerows, and in overgrown pastures, North Warren, *16635*, *18099*.

Saponaria officinalis var. *caucasica* F. T. Hubbard—Warren Co.: in abandoned meadows, North Warren, *16614*; along fencerows, Bear Lake, *18210*.

Silene antirrhina L.—Snyder Co.: in waste fields along old canal-bed on Isle of Que, Selinsgrove, *2865*.

Silene armeria L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *6700*, cited as "*Lychnis maritima* Hort." on page 41 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, Sheffield, *16530*, verif. Bailey.

Silene caroliniana Walt.—Snyder Co.: in evergreen woods on sunny hillsides, Selinsgrove, *2351*, distributed as "*S. pennsylvanica* Michx."

Silene compacta Mill.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3557*, det. Bailey, distributed as "*Lychnis maritima* Hort."

Silene cucubalus Wibel—Snyder Co.: in waste ground and fields, Selinsgrove, *1993*, cited as "*S. latifolia* (Mill.) Britten & Rendle" on page 42 of the Annotated List and so distributed. Warren Co.: along roadsides, Warren, *17419*.

Silene stellata (L.) Ait. f.—Warren Co.: in woodlands, Washington Park, Warren, *17426*.

Silene virginica L.—Warren Co.: at edge of woodlands, North Warren, *16363*.

MOLLUGINACEAE

Mollugo verticillata L.—Warren Co.: in roadways and paths, North Warren, *15409*.

MESEMBRYANTHEMACEAE

Aptenia cordifolia (L. f.) N. E. Br.—Warren Co.: in indoor cultivation, Warren, *14467*, det. Bailey.

Lampranthus spectabilis (Haw.) N. E. Br.—Warren Co.: in indoor cultivation, Warren, *14470*, det. Bailey.

ALSINACEAE

Alsine aquatica (L.) N. L. Britton—Fayette Co.: in moist soil, Connellsville, *3826*.

Alsine graminea (L.) N. L. Britton—Lackawanna Co.: along roadsides and margins of woods on Bald Mountain, Scranton, *6509*. Potter Co. in fields, Coudersport, *16393*. Snyder Co.: in waste ground and lawns, Selinsgrove, *2830*. Warren Co.: in outdoor cultivation and widely naturalized in waste ground and along edges of streams, North Warren, *15002*, verif. Bailey, *15265*.

Alsine humifusa (Rottb.) N. L. Britton—Monroe Co.: in damp soil along edge of brook, Buck Hill Falls, *2964*.

Alsine longifolia (Muhl.) N. L. Britton—Warren Co.: in fields and lawns, North Warren, *17410*.

Alsine media L.—Warren Co.: weed in cultivated ground and waste ground, North Warren, *14664*, *16188*.

Alsine uliginosa (J. A. Murray) N. L. Britton—Northumberland Co.: on moist cliffs in dense woods, Herndon, *4197*.

Arenaria serpyllifolia L.—Snyder Co.: in dry fields, Selinsgrove, *3197*. Warren Co.: between railroad ties on railroad embankments and in cinder pathways, North Warren, *15378, 17759*.

Cerastium arvense L.—Snyder Co.: in fields and roadside embankments on Isle of Que, near the Susquehanna River, Selinsgrove, *2297*.

Cerastium biebersteinii P. DC.—Warren Co.: in outdoor cultivation, North Warren, *14997*, verif. Bailey, *16266*, verif. Bailey.

Cerastium viscosum L.—Snyder Co.: in waste ground, Selinsgrove, *3831*.

Cerastium vulgatum var. *hirsutum* E. Fries—Snyder Co.: in dry fields and waste ground, Selinsgrove, *2339*, cited as "*C. vulgatum* L." on page 42 of the Annotated List. Warren Co.: in lawns and grassy fields, North Warren, *14734, 14891;* in grassy fields and waste places, Sheffield, *17358*.

Moehringia lateriflora (L.) Fenzl—Clearfield Co.: at edge of woods, Du Bois, *3241*.

Sabulina groenlandica (Retz.) Small—Monroe Co.: in dry fields, Buck Hill Falls, *2985*, distributed as "*Arenaria groenlandica* (Retz.) Spreng."

Sagina procumbens L.—Warren Co.: very abundant in lawns, Warren, *15048*.

Spergula arvensis L.—Warren Co.: in dry roadside banks, North Warren, *15809*.

PORTULACACEAE

Claytonia caroliniana Michx.—Snyder Co.: along banks of Penn's Creek, Penn Avon, *3146*. Warren Co.: in woodlands, North Warren, *17201;* in dense woods, Cranbrook Farm, North Warren, *17329*.

Claytonia virginica L.—Snyder Co.: in moist places along edge of Penn's Creek, Selinsgrove, *2311*. Warren Co.: in moist woods, Warren, *14497*.

Portulaca grandiflora Hook.—Warren Co.: in outdoor cultivation and escaped, North Warren, *15650*, verif. Bailey.

Portulaca oleracea L.—Warren Co.: in waste and cultivated ground, North Warren, *15240*.

Portulacaria afra Jacq.—Warren Co.: in indoor cultivation, Warren, *14568*, det. as "*Crassula* sp." by Clausen, *14830;* in indoor cultivation, North Warren, *16137*, det. Alexander.

POLYGONACEAE

Acetosella vulgaris Fourr.—Potter Co.: in waste ground, Coudersport, *16416*. Snyder Co.: in waste and cultivated ground, Selinsgrove, *2366*, distributed as "*Rumex acetosella L.*" Warren Co.: along roadsides and in waste ground, Warren, *14795;* in waste ground and gardens, North Warren, *14974;* in waste ground, Sheffield, *17361*.

Bilderdykia cilinodis (Michx.) Greene—Warren Co.: on rocky cliffs near Sheffield, *16332;* in woodlands, Bull Hill, Sheffield, *17460*.

Bilderdykia convolvulus (L.) Dumort.—Warren Co.: weed in cultivated ground, waste ground, and in flowerpots in greenhouse, Warren, *14552*.

Bilderdykia scandens (L.) Greene—Warren Co.: vine clambering over shrubs, forming an impenetrable tangle along roadside at edge of woods, North Warren, *15782*.

Fagopyrum esculentum Moench—Warren Co: in outdoor cultivation, persistent in formerly cultivated fields, and escaped along roadsides, North Warren, *15605;* in outdoor cultivation and along roadsides, Sheffield, *16534*, verif. Bailey.

Homalocladium platycladium (F. Muell.) L. H. Bailey—Warren Co.: in indoor cultivation, Warren, *14460*, det. as "*H. platycladum* Bailey" by Bailey.

Persicaria hydropiper var. *projecta* (Stanford) Moldenke—Forest Co.: along stream, Tionesta Dam, *16806*. Monroe Co.: along wet trails near streams, Buck Hill Falls, *2995*, cited as "*P. hydropiper* (L.) Opiz" on page 43 of the Annotated List and so distributed. Warren Co.: in moist ditches, waste ground, and forming tremendous colonies in moist soil along edge of old wood road, North Warren, *14877, 15433, 15625, 18073*.

Persicaria hydropiperoides (Michx.) Small—Warren Co.: in marsh on island in Conewango Creek, in moist ditches, and in tremendous colonies at edge of marshland, North Warren, *16704, 16789, 18095*.

Persicaria mitis Gilib.—Lackawanna Co.: in moist soil at edge of sidewalks, Scranton, *6512*. Warren Co.: in wet ditches, waste ground, and along woodland roads, North Warren, *15436, 17832*.

Persicaria orientalis (L.) Spach—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *2753*. Warren Co.: naturalized in marsh on island in Conewango Creek, North Warren, *18089*.

Persicaria pensylvanica var. *laevigata* (Fernald) Ferguson—Clinton Co.: in moist soil, Lock Haven, *3352*, cited as "*P. pennsylvanica* (L.) Small" on page 43 of the Annotated List and so distributed. Potter Co.: in wet ditches, Coudersport, *16715*. Warren Co.: in waste ground and on shale embankments along roadsides, North Warren, *15529, 15707;* in moist ditches, marshes, and waste ground, and in marsh on island in Conewango Creek, North Warren, *16739, 16825, 17928, 17980, 18088;* in grassy fields along Four Mile Creek, *18032*.

Persicaria punctata (Ell.) Small—Warren Co.: in waste ground, moist meadows, and marshy ground, North Warren, *17383, 17919, 17981, 18074;* in marshy ground along Four Mile Creek, *18040*.

Polygonum aviculare L.—Warren Co.: in and along margins of roadways and paths and in dry waste soil along roadsides, North Warren, *15112*, verif. Brenckle, *15308*, verif. Brenckle.

Polygonum erectum L.—Snyder Co.: in waste ground, Selinsgrove, *4193*.

Rheum rhaponticum L.—Snyder Co.: in outdoor cultivation, often persistent or escaped, Selinsgrove, *2361*. Warren Co.: in outdoor cultivation and escaped, North Warren, *15634*, verif. Bailey.

Rumex britannica L.—Warren Co.: in marshes, North Warren, *16782, 17982;* in muddy swamps along Conewango Creek between North Warren and Russell, *17563*.

Rumex crispus L.—Warren Co.: in grassy fields and waste ground, North Warren, *14885, 15059*.

Rumex obtusifolius L.—Potter Co.: in waste and cultivated ground, Coudersport, *16720*. Warren Co.: in waste and cultivated ground and along streams, North Warren, *14973*.

Tovara virginiana (L.) Raf.—Warren Co.: in moist ditches, thickets, along woodland roads, and in outdoor cultivation, North Warren, *15421, 16600;* in damp thickets, Sheffield, *17852*.

Tracaulon sagittatum (L.) Small—Forest Co.: on banks of streams along Tionesta Creek from Henry's Mills to Kelletville, *17629*. Warren Co.: in meadows, marshy ground, wet ditches, and along streams, North Warren, *15370, 16747*.

Tracaulon sagittatum f. *subalbidum* Moldenke—Warren Co.: in wet ditches, North Warren, *16670*.

CORRIGIOLACEAE

Anychia polygonoides Raf.—Schuykill Co.: in dense colonies along roadsides at edge of woods, Ashland, *7801*.

PHYTOLACCACEAE

Phytolacca americana L.—Potter Co.: along hedgerows, Coudersport, *16559*. Warren Co.: in waste ground and along fencerows, North Warren, *15310*.

CHENOPODIACEAE

Ambrina ambrosioides (L.) Spach—Snyder Co.: in dry waste ground, Penn Avon, *2761*, distributed as "*Chenopodium ambrosioides* L.;" in dry soil, Selinsgrove, *4181*, cited as "*Chenopodium glaucum* L." on page 44 of the Annotated List and so distributed.

Beta vulgaris L.—Warren Co.: in outdoor cultivation and escaped on dumps, North Warren, *15635*, verif. Bailey.

Beta vulgaris var. *cicla* L.—Warren Co.: in outdoor cultivation, North Warren, *15626*, verif. Bailey.

Blitum capitatum L.—Warren Co.: in waste and cultivated ground, North Warren, *15312*.

Chenopodium berlandieri ssp. *zschackei* (Murr) Zobel—Potter Co.: in waste ground, Coudersport, *16730*. Warren Co.: in waste ground, fields, roadsides, cultivated ground, and cinder driveways, North Warren, *15016*, *15317*, *18160*.

Chenopodium gigantospermum Aellen—Northumberland Co.: in woods at base of Mount Mahanoy, Fisher's Ferry, *3122*, cited as "*C. hybridum* L." on page 44 of the Annotated List and so distributed.

Chenopodium leptophyllum (Moq.) Nutt.—Warren Co.: very abundant in dry asparagus field, *18229*.

Chenopodium murale L.—Warren Co.: in waste ground, North Warren, *16435*.

Kochia scoparia var. *trichophila* (Schinz & Thell.) L. H. Bailey—Warren Co.: in outdoor cultivation and escaping as weed in cultivated ground, North Warren, *15952*, verif. Bailey.

Neobotrydium Moldenke, nom. nov.

Botrydium Spach, Hist. Vég. Phan. **5**:298. 1836 [not *Botrydium* Wallr., Ann. Bot. 153. 1815, nor *Botrydium* Kütz., 1843]. *Botrys* Nieuwl., Am. Midland Nat. **3**:274. 1914 [not *Botrys* Fourr., Ann. Soc. Linn. Lyon, n.s., **17**:138. 1869]. The generic name *Vulvaria* Bubani, Fl. Pyr. **1**:174. 1897, cannot be used for this genus either because Bubani's section *Euvulvaria*, presumably containing the type species, contains only species of *Chenopodium* not of the *Botrys* group.

Neobotrydium botrys (L.) Moldenke, comb. nov.

Chenopodium Botrys L., Sp. Pl., ed. 1, 219. 1753. *Botrydium aromaticum* Spach, Hist. Vég. Phan. **5**:299. 1836. *Botrys aromatica* (Spach) Nieuwl., Am. Midland Nat. **3**:274. 1914. *Vulvaria Botrys* (L.) Bubani, Fl. Pyr. **1**:174. 1897. *Botrydium Botrys* (L.) Small, Man. 466. 1933.—Lackawanna Co.: in waste ground along streets, Scranton, *6499*, cited as "*Botrydium botrys* (L.) Small" on page 44 of the Annotated List and distributed as "*Chenopodium botrys* L."

Spinacia oleracea L.—Warren Co.: in outdoor cultivation, North Warren, *15637*, verif. Bailey.

AMARANTHACEAE

Alternanthera amoena Voss—Warren Co.: in indoor cultivation, Warren, *14474*, det. Bailey, *14475*, det. Bailey; in indoor cultivation, North Warren, *16148*.

Alternanthera bettzickiana (Regel) Standl.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15973*, det. as "*A. bettzickiana*, Standl." by Bailey.

Amaranthus graecizans L.—Warren Co.: in waste and cultivated ground North Warren, *15648*, *18078*.

Amaranthus hybridus L.—Warren Co.: in waste and cultivated ground and on compost heaps, North Warren, *15309*, *17990*, *18075*.

Amaranthus retroflexus L.—Snyder Co.: in dry waste ground and gardens, Selinsgrove, *4202*. Warren Co.: in waste ground, cultivated fields, and compost heaps, North Warren, *15536*, *15946*, *17991*, *18077*.

Amaranthus tricolor var. *splendens* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *16424*, verif. Bailey.

Amaranthus viridis L.—Warren Co.: in waste and cultivated ground and along roadsides, North Warren, *15187*, *18076*.

Celosia argentea L.—Warren Co. in outdoor cultivation and naturalized as a weed in waste and cultivated ground, North Warren, *14992*, verif. Bailey, *18072*.

Celosia cristata L.—Warren Co.: in outdoor cultivation, North Warren, *15657*, verif. Bailey.

Celosia cristata var. *coccinea* A. DC.—Warren Co.: in outdoor cultivation, North Warren, *15402*, verif. Bailey.

Iresine herbstii Hook. f.—Snyder Co.: in outdoor cultivation along road from Selinsgrove to Penn Avon, *2765*. Warren Co.: in indoor cultivation and summer outdoor cultivation, North Warren, *16000*, verif. Bailey.

Iresine lindeni Van Houtte—Warren Co.: in indoor cultivation, Warren, *14473*, verif. Bailey; in indoor cultivation, North Warren, *14950*, det. as "*I. Lindenii*" by Bailey.

LINACEAE

Cathartolinum virginianum (L.) Reichenb.—Forest Co.: in thickets along Tionesta Creek from Henry's Mills to Kelletville, *17620*.

Linum grandiflorum Desf.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3552*. Warren Co.: in outdoor cultivation, North Warren, *16434*, verif. Bailey.

GERANIACEAE

Geranium carolinianum L.—Snyder Co.: roadsides near Bake Oven Hill, Selinsgrove, *3178*. Warren Co.: in waste and cultivated ground, North Warren, *14847*, *15061*, *16010*.

Geranium maculatum L.—Snyder Co.: in moist woodlands, Selinsgrove, *2345*. Warren Co.: in sunny woodlands, margins of woods, and moist ditches, Warren, *14528*, *14805*.

Pelargonium domesticum L. H. Bailey—Snyder Co.: in indoor cultivation, Selinsgrove, *3104*. Warren Co.: in indoor cultivation, North Warren, *15091*, verif. Bailey.

Pelargonium graveolens L'Hér.—Warren Co.: in indoor cultivation, North Warren, *14723*, verif. Bailey.

Pelargonium hortorum L. H. Bailey—Snyder Co.: in indoor cultivation, Selinsgrove, *2249*, cited as "*P. zonale* Willd." on page 46 of the Annotated List and so distributed, *2359*, cited as "*P. inquinans* Ait." and so distributed. Warren Co.: in indoor and summer outdoor cultivation, Warren, *14550*, verif. Bailey.

Pelargonium hortorum var. *marginatum* L. H. Bailey—Warren Co.: in indoor cultivation and summer outdoor cultivation, Warren, *14486*, det. Bailey.

Pelargonium peltatum Ait.—Warren Co.: in indoor cultivation, North Warren, *14721*, verif. Bailey.

Robertiella robertiana (L.) Hanks—Monroe Co.: in wood garden of Mrs. George W. Stratton, Buck Hill Falls, *3003*.

LIMNANTHACEAE

Floerkea prosepinacoides Willd.—Snyder Co.: along banks of Penn's Creek, Selinsgrove, *3161*. Warren Co.: in meadows along streams near Kinzua, *17216*.

OXALIDACEAE

Caudoxalis bowieana (Lodd.) Small—Warren Co.: in indoor cultivation, North Warren, *14726*, det. as "*Oxalis Bowieana*, Lodd." by Bailey.

Ionoxalis deppei (Lodd.) Small—Warren Co.: in indoor and outdoor cultivation, North Warren, *15249*, verif. Bailey.

Ionoxalis violacea (L.) Small—Snyder Co.: in woods, Selinsgrove, *3206*.

Oxalis montana Raf.—Warren Co.: in moist woods, Deerlick, near Sheffield, *16320*; in deep woods, Deerlick road, Sheffield, *17708*; among moss on decaying logs in woods, Chandler's Valley, *17826*.

Oxalis ortgiesi Regel—Warren Co.: in indoor cultivation, North Warren, *15229*, verif. Bailey.

Oxalis rubra St. Hil.—Snyder Co.: in indoor cultivation, Selinsgrove, *3175*, cited as "*Caudoxalis bowieana* (Lodd.) Small" on page 46 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *14762*, det. Bailey.

Xanthoxalis europaea (Jordan) Moldenke—Warren Co.: along wood roads, North Warren, *15716*.

Xanthoxalis europaea f. *cymosa* (Small) Moldenke—Potter Co.: in waste ground, Coudersport, *16394*. Warren Co.: in waste and cultivated ground, North Warren, *14968*, *17732*; in dry soil of roadside banks, Deerlick road, Sheffield, *17707*.

Xanthoxalis europaea f. *villicaulis* (Wiegand) Moldenke—Warren Co.: along margins of wood roads, North Warren, *15481*.

Xanthoxalis repens (Thunb.) Moldenke—Warren Co.: weed in and under greenhouse benches and in cultivated ground, Warren, *14575*.

Xanthoxalis rufa Small—Snyder Co.: at edge of walks and along side of buildings on campus of Susquehanna University, Selinsgrove, *3208*.

TROPAEOLACEAE

Tropaeolum majus L.—Warren Co.: in outdoor cultivation, North Warren, *15640*, verif. Bailey.

Tropaeolum majus var. *burpeei* Eyster & Burpee—Warren Co.: in indoor cultivation, North Warren, *14906*, verif. Bailey.

BALSAMINACEAE

Impatiens balsamina L.—Warren Co.: in indoor and outdoor cultivation and escaped on dumps and in waste ground, North Warren, *16003*, verif. Bailey.

Impatiens balsamina f. *pleniflora* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *16297*, verif. Bailey.

Impatiens biflora Walt.—Warren Co.: in wet ground along roadsides and by streams, North Warren, *15345*.

Impatiens pallida Nutt.—Snyder Co.: in and along old canal-bed on Isle of Que, Selinsgrove, *3109*. Warren Co.: in open or dense wet woods, North Warren, *15343*, *16773*, *17840*.

Impatiens pallida var. *alba* Clute—Warren Co.: along edge of stream, Warren, *15325*.

Impatiens sultani Hook. f.—Warren Co.: in indoor cultivation and as weed under greenhouse benches, North Warren, *15078*, verif. Bailey.

Impatiens sultani f. *variegata* Moldenke—Warren Co.: in indoor cultivation, North Warren, *15077* (type), verif. Bailey.

LYTHRACEAE

Cuphea llavea Llav. & Lex.—Warren Co.: in indoor cultivation, North Warren, *14923*, det. Bailey.

Cuphea platycentra Lem.—Warren Co.: in indoor cultivation, North Warren, *14720*, verif. Bailey.

Lythrum salicaria L.—Montgomery Co.: in marshy spot near creek, Collegeville, *13875*. Warren Co.: in outdoor cultivation, North Warren, *15109*, verif. Bailey.

OENOTHERACEAE

Chamaenerion spicatum (Lam.) S. F. Gray—Monroe Co.: in dense woods, Buck Hill Falls, *2996*, distributed as "*C. angustifolium* (L.) Scop." Warren Co.: along margin of woods, North Warren, *16618*; in open woods between Sheffield and Blue Jay, along the Tionesta Creek, *17583*.

Circaea alpina L.—Forest Co.: in moist woods along Tionesta Creek from Henry's Mills to Kelletville, *17642*. Monroe Co.: in woods along trail, Buck Hill Falls, *3002*. Warren Co.: in thick leaf-mold along small stream in damp dense woods, North Warren, *15427*, *16487*; in dense woodlands, Chandler's Valley, *17814*.

Circaea quadrisulcata var. *canadensis* (L.) Hara—Warren Co.: in dense damp woods, thickets, margins of wood roads, and in outside cultivation, North Warren, *15193*, verif. Bailey, *15339*, *16481*, *16599*, *17686*, *17769*.

Clarkia elegans f. *pleniflora* Moldenke—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *16366* (type), verif. Bailey.

Epilobium adenocaulon Haussk.—Warren Co.: in marshy ground, Willow Street Run, Sheffield, *18115*.

Epilobium coloratum Muhl.—Northumberland Co.: in moist ground on Montour Ridge, Northumberland, *2427*. Warren Co.: in wet ditches, marshes, and along streams, North Warren, *15348*, *16771*, *17932*; in moist meadows one mile southwest of Sheffield, *17004*; in marshy ground, Deerlick road, Sheffield, *17716*; in marsh, Chandler's Valley, *17828*.

Fuchsia hybrida Voss—Warren Co.: in indoor cultivation, North Warren, *15192*, verif. Bailey.

Gaura biennis L.—Snyder Co.: in fields on Isle of Que, Selinsgrove, *3110*.

Isnardia palustris var. *americana* P. DC.—Warren Co.: in muddy marsh between North Warren and Russell, *17895*; in mud along stream, near Sheffield, *18207*.

Kneiffia perennis (L.) Pennell—Potter Co.: in grassy fields, Coudersport, *16398*.

Kneiffia tetragona (Roth) Pennell—Warren Co.: in meadows and clearings in woodlands, North Warren, *15434*, verif. Pennell, *17773*; in open sunny fields between Irvington and Tideoute, *17501*; in wet meadows between North Warren and Russell, *17903*.

Kneiffia tetragona var. *longistipata* Pennell—Warren Co.: in marshes, North Warren, *16375*.

Lavauxia triloba (Nutt.) Spach—Dauphin Co.: in dry fields, Harrisburg, *1967*.

Oenothera biennis L.—Potter Co.: in dry grassy fields, Coudersport, *16555*. Warren Co.: along roadsides, in dry fields, and in waste ground, North Warren, *15197*, *15703*, *16467*, *16669*.

Oenothera lamarckiana Ser.—Potter Co.: in outdoor cultivation, Coudersport, *16414*, verif. Bailey. Snyder Co.: in outdoor cultivation on Isle of Que, Selinsgrove, *3222*.

Oenothera sp.—Lackawanna Co.: in outdoor cultivation, Scranton, *6508*.

HALORRHAGIDACEAE

Myriophyllum verticillatum L.—Snyder Co.: in indoor aquarium cultivation, Selinsgrove, *4338*.

CALLITRICHACEAE

Callitriche palustris L.—Snyder Co.: in mud of dried-up marshy land, Selinsgrove, *4203*. Warren Co.: in stagnant water of ponds, North Warren, *17003*.

THYMELAEACEAE

Daphne mezereum L.—Warren Co.: in outdoor cultivation, North Warren, *16180*, det. Rehder.

Dirca palustris L.—Potter Co.: in outdoor cultivation, Coudersport, *16157*.

NYCTAGINACEAE

Allionia nyctaginea Michx.—Lebanon Co.: in dry waste ground along roadsides, Avon, *3878*.

Buginvillaea glabra Choisy—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *16156*, verif. Bailey.

Buginvillaea glabra var. *sanderiana* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *14699*, verif. Bailey.

Buginvillaea glabra var. *variegata* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *14961*, verif. Bailey.

Mirabilis jalapa L.—Warren Co.: in outdoor cultivation, North Warren, *15949*, verif. Bailey.

PROTEACEAE

Grevillea robusta Cunn.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15066*, verif. Bailey.

CISTACEAE

Helianthemum chamaecistus Mill.—Warren Co.: in outdoor cultivation, North Warren, *14998*, verif. Bailey.

TAMARICACEAE

Tamarix juniperina Bunge—Snyder Co.: in outdoor cultivation, Selinsgrove, *2857*.

PASSIFLORACEAE

Passiflora racemosa Brot.—Warren Co.: in indoor cultivation, North Warren, *15956*, verif. Bailey.

CUCURBITACEAE

Cucumis melo L.—Warren Co.: in outdoor cultivation and escaped on dumps, North Warren, *15631*, det. Bailey, *15866*, verif. Bailey.

Cucumis sativus L.—Warren Co.: in outdoor cultivation and escaped on dumps, North Warren, *15316*, verif. Bailey.

Cucurbita pepo L.—Snyder Co.: naturalized in woods along rocky roadside, Shamokin Dam, *2755*. Warren Co.: in outdoor cultivation and growing as weed in cultivated fields and flower beds, North Warren, *15806*, verif. Bailey, *16661*.

Cucurbita pepo var. *melopepo* (L.) Alef.—Warren Co.: in outdoor cultivation and growing as weed in cultivated ground and flower beds, North Warren, *15320*, *16662*.

Cucurbita pepo var. *ovifera* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *15403*, verif. Bailey.

Echinocystis lobata (Michx.) T. & G.—Warren Co.: climbing over shrubs on banks of Allegheny River, Warren, *15335*; climbing over shrubs along streams, Sheffield, *16533*; climbing over shrubs and trees in thickets along Conewango Creek, North Warren, *16644*, *17984*.

Lagenaria leucantha (Duchesne) Rusby—Warren Co.: in outdoor cultivation and escaped in waste ground, North Warren, *15974*, verif. Bailey, *18070*.

Sicyos angulatus L.—Snyder Co.: climbing over trees and shrubs along Penn's Creek on Isle of Que, Selinsgrove, *2749*, cited as "*S. angulata*" on page 49 of the Annotated List and so distributed. Warren Co.: climbing into trees in thickets, North Warren, *15195*.

BEGONIACEAE

Begonia argenteo-guttata Lemoine—Snyder Co.: in indoor cultivation, Selinsgrove, *3558*, det. Bailey, distributed as "*B. maculata* Raddi" and cited as "*B. argenteoguttata*" on page 49 of the Annotated List. Warren Co.: in indoor cultivation, Warren, *14481*, verif. Bailey.

Begonia coccinea Hook.—Northumberland Co.: in indoor cultivation, Herndon, *2244*.

Beginia conchaefolia A. Dietr.—Warren Co.: in indoor cultivation, North Warren, *16134*, det. Bailey, distributed as "*B. sanguinea* Raddi" and so cited on page 13 of the Observed Flora of Warren.

Begonia gracilis H. B. K.—Lackawanna Co.: in indoor cultivation, Scranton, *4230*.

Begonia heracleifolia Cham. & Schlecht.—Snyder Co.: in indoor cultivation, Selinsgrove, *2778*. Warren Co.: in indoor cultivation, Warren, *14483*, verif. Bailey.

Begonia multiflora Benth.—Warren Co.: in indoor cultivation, North Warren, *14710*, det. Bailey.

Begonia rex-cultorum L. H. Bailey—Lackawanna Co.: in indoor cultivation, Scranton, *4231*, cited as "*B. rex* Putz" on page 50 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *16111*, verif. Bailey.

Begonia ricinifolia A. Dietr.—Warren Co.: in indoor cultivation, Warren, *14482*, verif. Bailey.

Begonia semperflorens Link & Otto—Warren Co.: in indoor cultivation, North Warren, *14595*, verif. Bailey.

Begonia semperflorens var. *calloides* Moldenke—Warren Co.: in indoor cultivation, North Warren, *15405* (type), det. as "*B. semperflorens* var." by Bailey.

Begonia semperflorens f. *plena* Moldenke—Warren Co.: in indoor cultivation, North Warren, *15141* (type), det. as "*B. semperflorens* var." by Bailey.

Begonia tubehybrida Voss—Snyder Co.: in indoor cultivation, Selinsgrove, *3224*.

CACTACEAE

Aporocactus flagelliformis (Mill.) Lem.—Warren Co.: in indoor cultivation, North Warren, *17116*.

Echinopsis eyriesii (Turpin) Zucc.—Warren Co.: in indoor cultivation, North Warren, *16171*, det. Alexander.

Epiphyllum ackermanii Haw.—Warren Co.: in indoor cultivation, Warren, *14838*, verif. Bailey; in indoor cultivation, North Warren, *16019*, verif. Bailey.

Epiphyllum guatemalense Britton & Rose—Warren Co.: in indoor cultivation, North Warren, *15519*, det. as "*Epiphyllum*, probably *E. guatemalense*, Britt. & Rose" by Bailey.

Epiphyllum sp.—Warren Co.: in indoor cultivation, North Warren, *16344*.

Hylocereus undatus (Haw.) Britton & Rose—Snyder Co.: in indoor cultivation, Selinsgrove, *3126*. Warren Co.: in greenhouse cultivation, North Warren, *16460*, verif. Bailey.

Nopalxochia phyllanthoides (P. DC.) Britton & Rose—Warren Co.: in indoor cultivation, North Warren, *17057*, det. Alexander, who says "one of the longest cultivated of all cacti."

Selenicereus grandiflorus (L.) Britton & Rose—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14919*, det. Bailey.

Zygocactus truncatus (Haw.) Schum.—Warren Co.: in indoor cultivation, North Warren, *15124*, verif. Bailey.

HYPERICACEAE

Hypericum androsaemum L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3858*.

Hypericum ascyron L.—Bedford Co.: along banks of streams, Bedford Springs, *3359*.

Hypericum boreale (N. L. Britton) Bicknell—Monroe Co.: in dry fields, Buck Hill Falls, *2990*.

Hypericum ellipticum Hook.—Fayette Co.: in wet soil, alt. 1,700 feet, Big Meadow Run, Farmington, *6883* [*E. L. Core 2933*].

Hypericum mutilum L.—Clearfield Co.: in marshy ground, Du Bois, *3929*. Warren Co.: in boggy soil along small woodland streams and in wet ditches, North Warren, *15346*, *15441*; in grassy fields, east of Russell, *16841*.

Hypericum perforatum L.—Potter Co.: in dry grassy fields, Coudersport, *16571*. Warren Co.: in dry fields about 2 miles west of Warren, *15165*; in grassy banks and fields, North Warren, *15274*, *16379*; in meadows along Conewango Creek between North Warren and Russell, *17579*.

Hypericum punctatum Lam.—Forest Co.: in grassy meadows along Tionesta Creek from Henry's Mills to Kellettville, *17627*. Warren Co.: in meadows, grassy fields, and along fencerows, North Warren, *15233*, *17868*; in grassy fields, Sheffield, *16528*; in grassy thickets between North Warren and Russell, *17904*.

TILIACEAE

Tilia americana L.—Snyder Co.: in woodlands and also cultivated, Selinsgrove, *2500*. Warren Co.: in woodlands, Warren, *14768*; in woods and also cultivated, North Warren, *14888*, *15418*.

Tilia americana f. *macrophylla* (Bayer) V. Engl.—Snyder Co.: in cultivation as street tree, Selinsgrove, *4171*, cited as "var. *macrophylla* Hort." on page 51 of the Annotated List and so distributed.

Tilia platyphyllos Scop.—Snyder Co.: in cultivation as street tree, Selinsgrove, *2496*. Warren Co.: in outdoor cultivation, North Warren, *14616*, verif. Bailey.

MALVACEAE

Abutilon hybridum Voss—Warren Co.: in indoor cultivation, North Warren, *14604*, verif. Bailey.

Abutilon pictum Walp.—Snyder Co.: in indoor cultivation, Selinsgrove, *2278*. Warren Co.: in indoor cultivation, North Warren, *14962*, verif. Bailey.

Abutilon striatum var. *thompsoni* Veitch—Lackawanna Co.: in indoor cultivation, Scranton, *4221*.

Abutilon theophrasti Medic.—Warren Co.: in waste and cultivated ground, North Warren, *15624*.

Althaea rosea Cav.—Warren Co.: in outdoor cultivation and widely escaped on dumps and along roadsides, North Warren, *15158*, verif. Bailey, *16457*, det. Bailey, distributed as "*A. ficifolia* Cav." and so listed on page 14 of the Observed Flora of Warren.

Althaea rosea f. *pleniflora* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15307* (type), verif. Bailey.

Hibiscus esculentus L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3555*.

Hibiscus moscheutos L.—Philadelphia Co.: in outdoor cultivation, Germantown, *8225*, cited as "*H. palustris* L." on page 52 of the Annotated List. Warren Co.: in outdoor cultivation, North Warren, *15511*, verif. Bailey.

Hibiscus palustris L.—Warren Co.: in outdoor cultivation, North Warren, *15971*, verif. Bailey.

Hibiscus rosa-sinensis L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14709*, verif. Bailey.

Hibiscus rosa-sinensis var. *calleri* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *16301*, verif. Bailey.

Hibiscus rosa-sinensis f. *plenus* Moldenke—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15400* (type), verif. Bailey.

Hibiscus schizopetalus Hook.—Warren Co.: in indoor cultivation, North Warren, *16225*, verif. Bailey.

Hibiscus syriacus L.—Warren Co.: in outdoor cultivation and escaping as seedling weeds, North Warren, *15398*, verif. Bailey.

Hibiscus syriacus f. *puniceus* Rehd.—Warren Co.: in outdoor cultivation, North Warren, *15399*, verif. Bailey.

Malva moschata L.—Potter Co.: in grassy meadows, Coudersport, *16575*. Warren Co.: in grassy fields and in outdoor cultivation, North Warren, *15137*, verif. Bailey, *15207*, *16603*; in grassy fields, Warpen Park, Warren, *16338*.

Malva moschata f. *alba* Moldenke—Potter Co.: in grassy meadows, Coudersport, *16576*. Warren Co.: in grassy fields about 2 miles west of Warren, *15166* (type); in grassy meadows along Conewango Creek between North Warren and Russell, *17559*.

Malva neglecta Wallr.—Snyder Co.: in waste and cultivated ground and along roadsides, Selinsgrove, *2388*, cited as "*M. rotundifolia* L." on page 52 of the Annotated List and so distributed. Warren Co.: in waste ground, Warren, *14804*; in waste and cultivated ground and lawns, North Warren, *15097*.

Malvaviscus grandiflorus H. B. K.—Warren Co.: in indoor cultivation, North Warren, *15412*, verif. Bailey.

Malvaviscus mollis P. DC.—Warren Co.: in indoor cultivation, North Warren, *14963*, verif. Bailey.

EUPHORBIACEAE

Acalypha godseffiana Mast.—Warren Co.: in indoor cultivation, North Warren, *16025*, verif. Bailey.

Acalypha rhomboidea Raf.—Warren Co.: in waste ground and shaded soil along roadsides, North Warren, *15226*, *15834*; in grassy fields, east of Russell, *16840*.

Acalypha wilkesiana Muell. Arg.—Warren Co.: in indoor cultivation, North Warren, *14707*, verif. Bailey.

Chamaesyce maculata (L.) Small—Snyder Co.: in fields, Selinsgrove, *4167*, cited as "*C. preslii* (Guss.) Arthur" on page 53 of the Annotated List and so distributed.

Chamaesyce rafinesquii (Greene) Small—Warren Co.: in gravel and cinders of roadways, North Warren, *18080*.

Chamaesyce supina (Raf.) Moldenke—Warren Co.: prostrate in waste ground, paths, and roadways, North Warren, *15238*.

Codiaeum variegatum var. *pictum* Muell. Arg.—Warren Co.: in indoor cultivation, Warren, *14826*, verif. Bailey.

Codiaeum variegatum var. *pictum* f. *trilobum* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *15963*, det. as "f. *trilobum* Hort." by Bailey.

Euphorbia fulgens Karw.—Warren Co.: in indoor cultivation, North Warren, *16099*, verif. Bailey.

Euphorbia splendens Bojer—Lackawanna Co.: in indoor cultivation, Scranton, *4222*. Warren Co.: in indoor cultivation, North Warren, *14966*, verif. Bailey.

Galarhoeus cyparissias (L.) Small—Snyder Co.: in outdoor cultivation and widely escaped and naturalized in graveyards and dumps, Selinsgrove, *2822*, distributed as "*Tithymalus cyparissias* (L.) Hill." Warren Co.: in meadows, Sheffield, *17379*.

Galarhoeus helioscopia (L.) Haw.—Potter Co.: growing as weed in cultivated and waste ground, Coudersport, *16712*.

Pedilanthus tithymaloides (L.) Poit.—Warren Co.: in indoor cultivation, North Warren, *14953*, verif. Bailey.

Poinsettia cyathophora (J. A. Murray) Small—Lackawanna Co.: in outdoor cultivation, Scranton, *6216*.

Poinsettia pulcherrima (Willd.) Graham—Warren Co.: in indoor cultivation, North Warren, *15414*, verif. Bailey, *16027*, verif. Bailey.

Ricinus communis L.—Warren Co.: in outdoor cultivation, North Warren, *15408*, verif. Bailey.

GROSSULARIACEAE

Chrysobotrya aurea (Pursh) Rydb.—Warren Co.: in outdoor cultivation and tending to escape, Warren, *14579*, verif. Bailey.

Chrysobotrya odorata (Wendl.) Rydb.—Snyder Co.: in outdoor cultivation on Isle of Que, Selinsgrove, *2298*, distributed as "*Ribes odoratum* Wendl." Warren Co.: in outdoor cultivation and tending to escape, North Warren, *16198*, verif. Bailey.

Grossularia cynosbati (L.) Mill.—Warren Co.: in woodlands, Deerlick, near Sheffield, *16316*.

Grossularia hirtella (Michx.) Spach—Forest Co.: in dense woods along Tionesta Creek from Henry's Mills to Kelletville, *17641*. Monroe Co.: in damp woods, Buck Hill Falls, *2991*, cited as "G. *oxyacanthoides* (L.) Mill." on page 55 of the Annotated List and so distributed. Warren Co.: in dense woods, Deerlick road, near Sheffield, *17283*.

Grossularia reclinata (L.) Mill.—Warren Co.: in outdoor cultivation, North Warren, *15245*, verif. Bailey.

Grossularia rotundifolia (Michx.) Coville & Britton—Snyder Co.: along Middle Creek, Kantz, *3822*.

Ribes americanum Mill.—Snyder Co.: in woods and in outdoor cultivation, Selinsgrove, *3167*. Warren Co.: in woodlands and along old wood roads, Warren, *14778*.

Ribes lacustre (Pers.) Poir.—Warren Co.: in moist dense woodlands, North Warren, *15585*.

Ribes sanguineum Pursh—Dauphin Co.: in outdoor cultivation, Dauphin, *4165*.

Ribes vulgare Lam.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2296*. Warren Co.: on moist banks of old wood road, Warren, *14800*; naturalized in thickets along edge of old wood road, North Warren, *15868*; in thickets along roadside, near Kinzua, *17237*.

HYDRANGEACEAE

Deutzia gracilis Sieb. & Zucc.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2449*. Warren Co.: in outdoor cultivation, North Warren, *14895*, verif. Bailey.

Deutzia lemoinei Lem.—Warren Co.: in outdoor cultivation, North Warren, *17444*, det. Rehder.

Deutzia myriantha Lemoine—Warren Co.: in outdoor cultivation, North Warren, *15528*, det. with a question by Rehder.

Deutzia scabra var. *candidissima* (Froebel) Rehd.—Warren Co.: in outdoor cultivation, North Warren, *15131*, verif. Bailey.

Hydrangea arborescens L.—Snyder Co.: on steep cliffs along banks of Penn's Creek, Penn Avon, *3093*.

Hydrangea arborescens f. *grandiflora* Rehd.—Warren Co.: in outdoor cultivation, North Warren, *15043*, verif. Bailey.

Hydrangea macrophylla f. *hortensis* (Maxim.) Rehd.—Warren Co.: in indoor and outdoor cultivation, North Warren, *15231*, verif. Bailey.

Hydrangea paniculata var. *grandiflora* Sieb.—Warren Co.: in outdoor cultivation, North Warren, *15652*, verif. Bailey, *18071*.

Philadelphus coronarius L.—Warren Co.: in outdoor cultivation, Warren, *14820*, verif. Bailey.

Philadelphus coronarius var. *aureus* Rehd.—Warren Co.: in outdoor cultivation, North Warren, *15027*, verif. Bailey.

Philadelphus coronarius var. *duplex* West.—Warren Co.: in outdoor cultivation, North Warren, *15036*, verif. Bailey.

Philadelphus falconeri Sarg.—Warren Co.: in outdoor cultivation, North Warren, *15034*, det. Rehder, *15311*, det. with a question by Rehder.

Philadelphus laxus Schrad.—Warren Co.: in outdoor cultivation, North Warren, *14934*, det. Bailey, *16365*, verif. Bailey, *16463*, det. Rehder.

Philadelphus microphyllus A. Gray—Warren Co.: in outdoor cultivation, North Warren, *14985*, verif. Bailey, *15032*, verif. Bailey.

Philadelphus nivalis Jacques—Warren Co.: in outdoor cultivation, North Warren, *15038*, det. Rehder, *17527*, det. Rehder.

Philadelphus nivalis f. *plenus* Rehd.—Warren Co.: in outdoor cultivation, North Warren, *15093*, det. Rehder.

Philadelphus pekinensis Rupr.—Warren Co.: in outdoor cultivation, North Warren, *15024*, det. Rehder, who says "leaves and flowers larger than usual."

Philadelphus pubescens Loisel.—Warren Co.: in outdoor cultivation, North Warren, *15030*, det. Rehder, *15135*, det. Rehder, *15224*, det. as "*P. pubescens* x ? *Falconeri*" by Rehder.

Philadelphus verrucosus Schrad.—Warren Co.: in outdoor cultivation, North Warren, *16660*, det. Rehder.

ROSACEAE

Agrimonia gryposepala Wallr.—Potter Co.: in meadows near woods, Coudersport, *16561*. Warren Co.: in woodlands, thickets, margins of woods, and along old wood roads, North Warren, *15365*, *15685*, *15860*, *17684*; in thickets along Conewango Creek between North Warren and Russell, *17573*.

Agrimonia parviflora Soland.—Warren Co.: in marshes and in wet ground along Conewango Creek, North Warren, *15563*, *16788*.

Agrimonia rostellata Wallr.—Warren Co.: in open woodlands, North Warren, *16483*, *17668*; in woodlands, Chandler's Valley, *17823*; in dense woods near Brookston, *18013*.

Agrimonia striata Michx.—Warren Co.: in woodlands, North Warren, *15803*.

Dalibarda repens L.—Warren Co.: abundant in leaf-mold in dense dark woods, North Warren, *15439*, *16674*, *17680*.

Duchesnea indica (H. C. Andr.) Focke—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *3198*.

Exochorda racemosa (Lindl.) Rehd.—Warren Co.: in outdoor cultivation, North Warren, *14751*, verif. Bailey.

Filipendula rubra (Hill) B. L. Robinson—Warren Co.: naturalized along roadsides in woodland clearings, North Warren, *17665*.

Filipendula ulmaria (L.) Maxim.—Warren Co.: in outdoor cultivation and escaped, North Warren, *15234*, verif. Bailey.

Fragaria chiloensis var. *ananassa* L. H. Bailey—Warren Co.: in outdoor cultivation and persistent, North Warren, *15763*, verif. Bailey.

Fragaria vesca L.—Snyder Co.: on railroad embankment and among ties, Selinsgrove, *2299*. Warren Co.: in deep woods, Washington Park, Warren, *17427*.

Fragaria virginiana Duchesne—Potter Co.: in dry fields, Coudersport, *17533*. Warren Co.: in sunny clearings, fields, meadows, and hedgerows, Warren, *14519*, *14787*; in grassy fields, North Warren, *14677*.

Geum aleppicum var. *strictum* (Ait.) Fernald—Warren Co.: in moist thickets at edge of Conewango Creek, North Warren, *15557*.

Geum canadense Jacq.—Forest Co.: in meadows along Tionesta Creek from Henry's Mills to Kelletville, *17632*. Warren Co.: in hedgerows, thickets, and along wood roads, North Warren, *15371*, *15672*, *16497*; in fields near stream, Cranbrook Farm, North Warren, *17335*; in fields near brook, Bull Hill, Sheffield, *17455*.

Geum chiloense Balb.—Warren Co.: in outdoor cultivation, North Warren, *17731*.

Gillenia trifoliata (L.) Moench—Snyder Co.: in woods, Selinsgrove, *2479*. Warren Co.: in open woodlands and along margins of wood roads, North Warren, *15425*, *16347*; in open woods between Irvington and Tideoute, *17476*.

Kerria japonica P. DC.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4307*.

Kerria japonica var. *pleniflora* Witte—Snyder Co.: in outdoor cultivation, Selinsgrove, *2402*, distributed as "var. *florepleno* Hort." and cited as "var. *plena* Hort." on page 56 of the Annotated List.

Physocarpus opulifolius (L.) Maxim.—Snyder Co.: on banks of the Susquehanna River and along the borders of Middle Creek, Selinsgrove, *2864*, distributed as "*Opulaster opulifolius* (L.) Kuntze" and so cited on page 56 of the Annotated List.

Physocarpus opulifolius var. *luteus* (Kirchn.) Zabel—Warren Co.: in outdoor cultivation, North Warren, *14918*, verif. Bailey.

Potentilla argentea L.—Monroe Co.: in fields, Buck Hill Falls, *2965*.

Potentilla monspeliensis L.—Warren Co.: in waste and cultivated ground, in marsh along small stream in woodlands, and in outdoor cultivation, North Warren, *14981*, verif. Bailey, *15096*, *15321*, *15445*.

Potentilla recta L.—Potter Co.: in dry grassy fields, Coudersport, *16569*, *17540*. Warren Co.: in grassy fields about 2 miles west of Warren, *15172;* in grassy fields and pastures, North Warren, *15645;* in grassy fields between Irvington and Tideoute, *17491*.

Potentilla simplex Michx.—Potter Co.: in fields and along roadsides, Coudersport, *16399*. Warren Co.: in dry fields, lawns, waste ground, and along roadsides, Warren, *14801;* in grassy fields, Sheffield, *17352*.

Rhodotypos scandens (Thunb.) Mak.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2423*, cited as "*R. kerrioides* Sieb. & Zucc." on page 57 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *15927*, verif. Bailey.

Rosa alba L.—Warren Co.: in outdoor cultivation against walls, North Warren, *15051*, verif. Bailey.

Rosa blanda Ait.—Clearfield Co.: in meadows, Du Bois, *1998*.

Rosa borboniana Desp.—Warren Co.: in indoor cultivation, often infested with *Sphaerotheca pannosa*, North Warren, *16119*, verif. Bailey.

Rosa canina L.—Warren Co.: in outdoor cultivation, North Warren, *15026*, det. as "*R. canina* L. var." by Rehder.

Rosa carolina L.—Potter Co.: in thickets, Coudersport, *16392*. Warren Co.: in dense woods, hedgerows, and thickets, North Warren, *15578*, *16499;* in meadows between Irvington and Tideoute, *17509*.

Rosa centifolia L.—Warren Co.: in outdoor cultivation, North Warren, *15106*, det. as "*R. multiflora* x ?" by Rehder.

Rosa centifolia var. *muscosa* (Mill.) Ser.—Warren Co.: in outdoor cultivation, North Warren, *15105*, verif. Bailey.

Rosa chinensis Jacq.—Warren Co.: in outdoor cultivation, North Warren, *15057*, det. Bailey, det. as "*R. chinensis* x ?" by Rehder.

Rosa cinnamomea L.—Snyder Co.: along fencerows and roadsides, Penn Avon, *2443*.

Rosa hugonis Hemsl.—Warren Co.: in outdoor cultivation and tending to escape, North Warren, *14920*, verif. Bailey, *16587*, verif. Bailey.

Rosa multiflora Thunb.—Warren Co.: in outdoor cultivation, North Warren, *15074*, det. Bailey, det. as "*R. multiflora* var. ?" by Rehder.

Rosa multiflora var. *platyphylla* Thory—Warren Co.: in outdoor cultivation, North Warren, *16451*, verif. Bailey.

Rosa odorata f. *ochroleuca* (Lindl.) Rehd.—Warren Co.: in indoor greenhouse cultivation as a high-climbing woody vine, North Warren, *15070*, verif. Bailey.

Rosa palustris Marsh.—Warren Co.: in marshes and in outdoor cultivation, North Warren, *16708*, det. Rehder, *17674*.

Rosa polyanthella Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15191*, det. as "*R. multiflora* x ? *chinensis*" by Rehder.

Rosa polyanthella var. *nana* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *14970*, det. as "*R. multiflora*, Thunb. x" by Bailey, listed as "*R. polyanthella*" on page 15 of the Observed Flora of Warren.

Rosa rubiginosa L.—Mifflin Co.: on fences along roadsides, Reedsville, *2482*.

Rosa rugosa Thunb.—Warren Co.: in outdoor cultivation, North Warren, *14700*, verif. Bailey, *14916*, verif. Bailey.

Rubacer odoratum (L.) Rydb.—Potter Co.: along margins of woods, Coudersport, *17542*. Warren Co.: at margins of woods and in outdoor cultivation, North Warren, *15116*, verif. Bailey; at edge of woods, Warpen Park, Warren, *16335*; in thickets at edge of woods between Irvington and Tideoute, *17478*.

Rubus allegheniensis Porter—Potter Co.: at edge of woods, Coudersport, *16391*. Snyder Co.: in thickets and along hedgerows, *2824*. Warren Co.: in thickets, fencerows, and along margins of wood roads, North Warren, *15453*, verif. Bailey.

Rubus baileyanus N. L. Britton—Bedford Co.: along roadsides at edge of woodlands, Bedford Springs, *3242*.

Rubus flagellaris Willd.—Northumberland Co.: creeping in dry soil along roadsides, Northumberland, *2398*, cited as "*R. procumbens* Muhl." on page 57 of the Annotated List and so distributed. Warren Co.: along old wood roads and on hilltop at Washington Park, *14794*, det. Bailey, *17421*; prostate on dry roadside banks, Chandler's Valley, *17815*.

Rubus hispidus L.—Monroe Co.: in damp woodlands, Buck Hill Falls, *2994*. Warren Co.: procumbent among leaf-mold in dense woodlands and swamps, North Warren, *15680*, verif. Bailey, *16374*; in marshy woods between Sheffield and Blue Jay, along the Tionesta Creek, *17590*.

Rubus idaeus L.—Warren Co.: in outdoor cultivation and widely escaped along fences and hedges, North Warren, *14728*, cited as "*R. idaeus* var. *vulgatus* Arrhen." on page 16 of the Observed Flora of Warren.

Rubus occidentalis L.—Snyder Co.: in thickets, along fences and roadsides, and at borders of woods on the Isle of Que, Selinsgrove, *2838*. Warren Co.: forming thickets along roadsides, fences, hedges, and borders of woods, often growing with *R. idaeus*, *R. strigosus*, and *R. allegheniensis*, also in outdoor cultivation, North Warren, *15352*, det. Bailey, *15628*, det. Bailey, *15781*, det. Bailey, *15835*, det. Bailey, *15840*, det. Bailey.

Rubus strigosus Michx.—Warren Co.: along fences and old wood roads, Warren, *14793*, det. Bailey; in thickets along roadsides and at edge of woodlands, North Warren, *15780*, verif. Bailey, *15841*, verif. Bailey; in open thickets 1 mile southwest of Sheffield, *17015*; in hedgerows along Conewango Creek between North Warren and Russell, *17567*.

Sanguisorba canadensis L.—Warren Co.: in moist meadows, North Warren, *16705*; in meadows between North Warren and Russell, *17881*.

Sanguisorba minor Scop.—Snyder Co.: in outdoor cultivation and escaped, Salem, *3193*.

Sorbaria sorbifolia (L.) A. Br.—Lackawanna Co.: in outdoor cultivation, Scranton, *6510*. Monroe Co.: in outdoor cultivation and escaped, Buck Hill Falls, *2963*.

Spiraea alba Du Roi—Warren Co.: large colonies in moist ditches and at edge of thickets along Conewango Creek and in outdoor cultivation, North Warren, *15219*, det. Rehder, *15569*, *16543*, *16699*; in thickets along Conewango Creek between North Warren and Russell, *17565*; in moist meadows, Chandler's Valley, *17813*.

Spiraea albiflora (Miq.) Zabel—Warren Co.: in outdoor cultivation, North Warren, *15373*, verif. Bailey.

Spiraea billiardii Hérincq—Warren Co.: in outdoor cultivation, North Warren, *15237*, verif. Bailey.

Spiraea bumalda var. *anthony-watereri* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15118*, verif. Bailey.

Spiraea bumalda f. *variegata* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15157* (type), verif. Bailey.

Spiraea chamaedryfolia L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3867*.

Spiraea latifolia Borkh.—Warren Co.: in outdoor cultivation, North Warren, *15220*, det. Rehder.

Spiraea prunifolia Sieb. & Zucc.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2477*, cited as "var. *plena* Schneid." on page 58 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, persistent, and escaped, North Warren, *14598*, verif. Bailey.

Spiraea prunifolia f. *simpliciflora* Nakai—Warren Co.: in outdoor cultivation, North Warren, *14739*, verif. Bailey.

Spiraea reevesiana Lindl.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3871*.

Spiraea thunbergii Sieb.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2295*.

Spiraea trichocarpa Nakai—Potter Co.: in outdoor cultivation, Coudersport, *16271*, verif. Bailey.

Spiraea vanhouttei (Briot) Zabel—Snyder Co.: in outdoor cultivation, Selinsgrove, *2457*, cited as "*S. vanhouttei* Zabel" on page 58 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *14599*, verif. Bailey, *14741*, verif. Bailey.

Waldsteinia fragarioides (Michx.) Tratt.—Potter Co.: in woodlands, Coudersport, *16275*. Snyder Co.: in fields near edge of woodland, Shamokin Dam, *2367*, erroneously listed as "*Waldesteinia fragarioides*" on page 58 of the Annotated List and so distributed. Warren Co.: in sunny fields and marshes, Warren, *14522*; in marshy ground, dense woodlands, and margins of woods, North Warren, *14587*, *15353*, *17682*.

MALACEAE

Amelanchier canadensis (L.) Medic.—Potter Co.: in woods, Coudersport, *16278*. Snyder Co.: in woods along banks of Penn's Creek, Penn Avon, *2274*. Warren Co.: in woods, along fencerows, and in outdoor cultivation, North Warren, *14600*, verif. Bailey, *15832*, det. Rehder, *17196*.

Amelanchier oblongifolia Roem.—Snyder Co.: in thickets along roadsides, Selinsgrove, *3851*, cited as "*A. oblongifolia* (T. & G.) Roem." on page 58 of the Annotated List and so distributed.

Aronia arbutifolia (L.) Ell.—Snyder Co.: in woods and thickets, Selinsgrove, *2840*. Warren Co.: in outdoor cultivation, North Warren, *16212*, verif. Bailey; in marshy ground, Bear Lake, *18211*.

Aronia melanocarpa (Michx.) Ell.—Snyder Co.: in woodlands, Selinsgrove, *3859*.

Aronia prunifolia (Marsh.) Rehd.—Snyder Co.: along margins of wood roads and in thickets, Troxelville, *3189*, distributed as "*A. atropurpurea* Britton."

Chaenomeles lagenaria (Loisel.) Koidz.—Warren Co.: in outdoor cultivation and tending to spread, North Warren, *14760*, verif. Bailey, *16193*, verif. Bailey.

Chaenomeles superba f. *rosea* (Froebel) Rehd.—Warren Co.: in outdoor cultivation, North Warren, *14761*, verif. Bailey.

Crataegus calpodendron (Ehrh.) Medic.—Warren Co.: in dense thickets on hillside, Washington Park, Warren, *17423*, det. Palmer, *17428*, det. Palmer.

Crataegus coccinea L.—Snyder Co.: in open woods and hedges, Selinsgrove, *3187*.

Crataegus crus-galli L.—Snyder Co.: in old fields and along fencerows, Selinsgrove, *2417*.

Crataegus dodgei Ashe—Warren Co.: in open woodlands near Sheffield, *17412*, det. Palmer.

Crataegus drymopila Sarg.—Warren Co.: in dense thickets on hillside, Washington Park, Warren, *17425*, det. Palmer, *17432*, det. Palmer, *17433*, det. Palmer.

Crataegus gruberi Ashe—Warren Co.: at edges of clearings in woods, North Warren, *15551*, det. Palmer.

Crataegus holmesiana var. *villipes* Ashe—Warren Co.: in outdoor cultivation, North Warren, *15033*, det. Palmer.

Crataegus macrosperma Ashe—Warren Co.: in hedgerows, Warren, *14776*, det. Palmer.

Crataegus oxyacantha L.—Clearfield Co.: in outdoor cultivation, Du Bois, *1982*. Warren Co.: in outdoor cultivation, North Warren, *14671*, verif. Bailey, *14746*, verif. Bailey.

Crataegeus oxyacantha var. *pauli* Rehd.—Warren Co.: in outdoor cultivation, Warren, *14819*, det. Palmer.

Crataegeus oxyacantha var. *plena* West.—Warren Co.: in outdoor cultivation, North Warren, *16244*, verif. Bailey.

Crataegeus pruinosa (Wendl.) K. Koch—Warren Co.: in hedgerows and in dense

thickets on hillside in Washington Park, Warren, *14779*, det. Palmer, *17424*, det. Palmer.

Crataegus pruinosa var. *dissona* (Sarg.) Egglest.—Warren Co.: in hedgerows and fields at margins of woodlands and in dense thickets on hillside in Washington Park, Warren, *14786*, det. with a question by Palmer, *17431*, det. Palmer.

Crataegus prunifolia (Poir.) Pers.—Warren Co.: in outdoor cultivation, Warren, *15047*, det. Palmer.

Crataegus punctata Jacq.—Potter Co.: in thickets, Coudersport, *17534*, verif. Palmer. Susquehanna Co.: along fencerows, Hop Bottom, *2861*. Warren Co.: in thickets near Conewango Creek, in hedgerows, and in outdoor cultivation, North Warren, *14856*, det. Palmer, *15545*, verif. Palmer, *17405*, det. Palmer; at edge of woods, Sheffield, *16527*, verif. Palmer; in dense thickets on hillside, Washington Park, Warren, *17438*, verif. Palmer.

Crataegus roanensis Ashe—Warren Co.: in dense thickets on hillside, Washington Park, Warren, *17434*, det. Palmer.

Crataegus succulenta var. *macracantha* (Lodd.) Egglest.—Warren Co.: in dense thickets on hillside, Washington Park, Warren, *17429*, det. with a question by Palmer, *17437*, det. with a question by Palmer.

Cydonia oblonga Mill.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2357*.

Eriobotrya japonica Lindl.—Warren Co.: in greenhouse cultivation, North Warren, *18069*.

Malus atrosanguinea (Spaeth) Schneid.—Warren Co.: in outdoor cultivation, North Warren, *14703*, verif. Bailey.

Malus coronaria (L.) Mill.—Snyder Co.: on sunny hillsides above Herman's quarry, Penn Avon, *3190*. Warren Co.: on hillsides, Warren, *14771*; in hedgerows, Sheffield, *17348*.

Malus floribunda Sieb.—Northumberland Co.: in outdoor cultivation, Sunbury, *2415*.

Malus ioesis f. *plena* (Schneid.) Rehd.—Warren Co.: in outdoor cultivation, North Warren, *14756*, det. Bailey.

Malus pumila Mill.—Snyder Co.: in outdoor cultivation and escaped along fencerows, in thickets, and at margins of woods, Selinsgrove, *2305*, *2460*. Warren Co.: in outdoor cultivation, in thickets, and in woodlands, North Warren, *14615*, verif. Bailey. The first two of these collections were distributed as "*M. sylvestris* Mill."

Photinia serrulata Lindl.—Snyder Co.: in indoor cultivation, Selinsgrove, *3815*.

Pyrus communis L.—Snyder Co.: in outdoor cultivation and escaped along roadsides, Selinsgrove, *2306*. Warren Co.: in outdoor cultivation and escaped in thickets and hedgerows, North Warren, *15232*, verif. Bailey.

Sorbus americana Marsh.—Monroe Co.: in woods and in outdoor cultivation, Buck Hill Falls, *2981*.

Sorbus aucuparia L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2369*. Warren Co.: in outdoor cultivation and abundantly escaped as seedlings in waste and cultivated ground, North Warren, *14667*, verif. Bailey.

Sorbus hybrida L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3861*. Warren Co.: in outdoor cultivation, North Warren, *14705*, verif. Bailey.

AMYGDALACEAE

Amygdalus glandulosa f. **sinensis** (Pers.) Moldenke, comb. nov.

Prunus sinensis Pers., Syn. Pl. 2: 36. 1807.—Warren Co.: in outdoor cultivation, North Warren, *14737*, det. as "*Prunus glandulosa*, Thunb." by Bailey.

Amygdalus persica L.—Snyder Co.: in outdoor cultivation and abundantly escaped along fences and hedgerows, Selinsgrove, *2282*. Warren Co.: in outdoor cultivation and escaped along roadsides and trash piles, Warren, *15327*.

Padus avium Mill.—Snyder Co.: in outdoor cultivation along Susquehanna River on Isle of Que, Selinsgrove, *3835*.

Padus nana (Du Roi) Roem.—Snyder Co.: in woods along old canal-bed on Isle of Que, Selinsgrove, *2364*. Warren Co.: in outdoor cultivation, in thickets,

hedgerows, and margins of woods, North Warren, *14743*, verif. Bailey, *16700*, *17194*; in thickets, near Kinzua, *17226*.

Padus virginiana (L.) Mill.—Snyder Co.: in woodlands and along fencerows, Selinsgrove, *2439*. Warren Co.: in woodlands, along fences and hedges, and in outdoor cultivation, North Warren, *14882*, det. as "*Prunus serotina* Ehrh." by Bailey.

Prunus americana Marsh.—Snyder Co.: along edge of Middle Creek, Selinsgrove, *3157*. Warren Co.: in large colonies along fencerows, North Warren, *15598*.

Prunus armeniaca L.—Schuylkill Co.: in outdoor cultivation, Gordon, *2835*.

Prunus avium L.—Snyder Co.: in outdoor cultivation and widely naturalized in woods and thickets and along fences and hedges, Selinsgrove, *2275*. Warren Co.: in outdoor cultivation, persistent, and naturalized in woodlands, North Warren, *16419*, verif. Bailey.

Prunus cerasifera var. *atropurpurea* Jaeg.—Warren Co.: in outdoor cultivation, Warren, *14816*, verif. Bailey; in outdoor cultivation, North Warren, *17195*.

Prunus cerasus L.—Snyder Co.: in outdoor cultivation on Isle of Que, Selinsgrove, *2290*. Warren Co.: in outdoor cultivation, North Warren, *15104*, verif. Bailey.

Prunus domestica L.—Snyder Co.: in outdoor cultivation and escaped along fences and hedges, Selinsgrove, *2291*. Warren Co.: in outdoor cultivation, North Warren, *16207*, verif. Bailey; escaped from cultivation, near Kinzua, *17236*.

Prunus insititia L.—Snyder Co.: along fencerows on road from Penn Avon to Kratzerville, *3145*.

Prunus mahaleb L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4534*.

Prunus nigra Ait.—Snyder Co.: along hedges and fencerows, Selinsgrove, *2810*.

Prunus pensylvanica L. f.—Snyder Co.: in woods and along wood roads, Troxelville, *3841*, cited as "*Prunus pennsylvanica*" on page 60 of the Annotated List and so distributed. Warren Co.: in thickets, Sheffield, *17376*.

Prunus sieboldii (Carr.) Wittm.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2430*, cited as "*P. sieboldii* Wittm." on page 60 of the Annotated List and so distributed.

Prunus subhirtella var. *pendula* (Maxim.) Tanaka—Snyder Co.: in outdoor cultivation, Selinsgrove, *2269*.

Prunus triloba Lindl.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2341*, cited as "*P. triloba* var. *plena* Hort." on page 60 of the Annotated List and so distributed.

CALYCANTHACEAE

Calycanthus fertilis Walt.—Warren Co.: in outdoor cultivation, North Warren, *15136*, verif. Bailey.

Calycanthus fertilis var. *ferax* Rehd.—Warren Co.: in outdoor cultivation, North Warren, *14702*, verif. Bailey, *15126*, verif. Bailey.

Calycanthus floridus L.—Snyder Co.: in outdoor cultivation, North Warren, *15190*, verif. Rehder.

CAESALPINIACEAE

Cercis canadensis L.—Warren Co.: in outdoor cultivation, North Warren, *15526*, verif. Bailey.

Ditremexa marilandica (L.) Britton & Rose—Snyder Co.: along roadsides, Selinsgrove, *3124*, distributed as "*Cassia marilandica* L."

Gleditsia triacanthos L.—Snyder Co.: along the banks of the Susquehanna River and in outdoor cultivation, Selinsgrove, *2866*.

Gleditsia triacanthos f. *inermis* (Pursh) Fassett—Snyder Co.: growing with the typical form along the banks of the Susquehanna River on Isle of Que, Selinsgrove, *3863*, cited as "var. *inermis* Pursh" on page 61 of the Annotated List and so distributed.

Gymnocladus dioica (L.) K. Koch—Snyder Co.: in outdoor cultivation, Selinsgrove, *2494*.

MIMOSACEAE

Mimosa pudica L.—Warren Co.: in indoor cultivation, North Warren, *16592*.

FABACEAE

Amphicarpa bracteata (L.) Fernald—Warren Co.: climbing over tall herbs in thickets and hedges and along fences and old wood roads, North Warren, *15691*, *16621*.

Amphicarpa bracteata var. *comosa* (L.) Fernald—Warren Co.: climbing over tall weeds along Conewango Creek, North Warren, *15549*.

Apios americana Medic.—Warren Co.: climbing over tall herbs in thickets and borders of woods, North Warren, *16774*, *17698*.

Arachis hypogaea L.—Warren Co.: in outdoor cultivation, North Warren, *17660*.

Baptisia australis R. Br.—Warren Co.: in outdoor cultivation, tending to become weedy, North Warren, *15623*, verif. Bailey.

Baptisia tinctoria (L.) Vent.—Warren Co.: in dense woodlands, North Warren, *15852*.

Cicer arietinum L.—Warren Co.: in outdoor cultivation, North Warren, *17988*.

Cladrastis lutea (Michx. f.) K. Koch—Warren Co.: in outdoor cultivation, North Warren, *17445*, det. Rehder.

Colutea arborescens L.—Warren Co.: in outdoor cultivation, Warren, *14817*, verif. Bailey.

Coronilla varia L.—Warren Co.: in outdoor cultivation and persistent, North Warren, *15055*, verif. Bailey.

Cytisus canariensis (L.) Kuntze—Warren Co.: in indoor cultivation, North Warren, *16133*, verif. Bailey.

Desmodium acuminatum (Michx.) P. DC.—Warren Co.: in damp open woods, along roadsides, and on wooded banks of Conewango Creek, North Warren, *15606*, *16498*, *17775*.

Desmodium acuminatum f. *chandonnetii* (Lunell) Fassett—Warren Co.: growing with the typical form in woodlands and on wooded banks of Conewango Creek, North Warren, *15837*, *17776*.

Desmodium canadense (L.) P. DC.—Warren Co.: in dry soil along roadside by creek, Warren, *15334*; along roadsides, Cornplanter, *16536*; along fencerows, North Warren, *16611*.

Desmodium dillenii Darl.—Forest Co.: in meadows, Tionesta Fish Hatchery, *16819*, verif. Monachino.

Desmodium nudiflorum (L.) P. DC.—Warren Co.: in dense woodlands, North Warren, *15457*, *17916*.

Desmodium paniculatum (L.) P. DC.—Warren Co.: in open woods, grassy fields, thickets, and along fences, North Warren, *15475*, *16765*, *17861*.

Desmodium rotundifolium (Michx.) P. DC.—Warren Co.: trailing at edge of woods, North Warren, *15692*.

Laburnum anagyroides Medic.—Warren Co.: in outdoor cultivation, North Warren, *15301*, verif. Bailey.

Lathyrus latifolius L.—Warren Co.: in outdoor cultivation and escaped along fencerows, North Warren, *15060*, verif. Bailey, *15654*; escaped along hedgerow about 2 miles west of Warren, *15169*.

Lathyrus latifolius var. *albus* Wyman & Harshberger—Warren Co.: in outdoor cultivation and escaped, North Warren, *15133*, verif. Bailey.

Lathyrus ochroleucus Hook.—Warren Co.: in rocky woods, North Warren, *16237*; in thickets, near Sheffield, *17411*.

Lathyrus odoratus L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2327*. Warren Co.: in indoor and outdoor cultivation, Warren, *14556*, verif. Bailey.

Lespedeza hirta (L.) Hornem.—Warren Co.: along sides of wood roads and in thickets, North Warren, *15851*.

Lespedeza intermedia (S. Wats.) N. L. Britton—Warren Co.: in open woods, North Warren, *15793*, *16622*.

Lespedeza repens (L.) Bart.—Monroe Co.: trailing in dry open fields, Buck Hill Falls, *2669*.

Lespedeza thunbergii (P. DC.) Nakai—Warren Co.: in outdoor cultivation, North Warren, *16997*.

Lupinus hirsutus L.—Warren Co.: in outdoor cultivation, North Warren, *15822*, det. as "probably *L. hirsutus*" by Bailey.

Lupinus perennis L.—Snyder Co.: in open clearing on hilltop overlooking Middle Creek, Selinsgrove, *2380*.

Lupinus polyphyllus Lindl.—Warren Co.: in outdoor cultivation, North Warren, *14898*, verif. Bailey.

Lupinus polyphyllus var. *albiflorus* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *14907*, verif. Bailey.

Lupinus polyphyllus var. *roseus* L. H. Bailey—Warren Co.: in outdoor cultivation, Warren, *14823*, verif. Bailey.

Medicago lupulina L.—Warren Co.: in waste and cultivated ground and in lawns, North Warren, *14852*, *17811*; in grassy fields 1 mile southwest of Sheffield, *17017*.

Medicago sativa L.—Warren Co.: in outdoor cultivation and escaped in grassy fields and along roadsides, North Warren, *15056*, *15204*, *16378*.

Melilotus alba Desr.—Warren Co.: along fencerows and in waste ground, North Warren, *15203*.

Melilotus officinalis (L.) Lam.—Warren Co.: in waste ground and along roadsides, North Warren, *15015*.

Phaseolus limensis var. *limenanus* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *15941*, verif. Bailey.

Phaseolus vulgaris var. *humilis* Alef.—Warren Co.: in outdoor cultivation and escaped on trash piles, North Warren, *15235*, verif. Bailey.

Pisum sativum L.—Warren Co.: in outdoor cultivation and escaped on trash piles, North Warren, *15943*, verif. Bailey.

Pisum sativum var. *arvense* (L.) Poir.—Warren Co.: in cultivation in fields, North Warren, *15098*, verif. Bailey.

Pisum sativum var. *humile* Poir.—Warren Co.: in outdoor cultivation, North Warren, *15029*, verif. Bailey.

Robinia hispida L.—Warren Co.: in hedgerows and fencerows, North Warren, *16360*, *16537*; in outdoor cultivation, 10 to 12 feet tall, Sheffield, *17448*, verif. Rehder.

Robinia pseudoacacia L.—Potter Co.: along hedgerows, Coudersport, *16397*. Snyder Co.: forming thickets along banks of the Susquehanna River and in abandoned fields, Selinsgrove, *2826*, cited as "*R. pseudo-acacia*" on page 65 of the Annotated List and so distributed.

Robinia viscosa Vent.—Warren Co.: along roadsides and fencerows, North Warren, *15595*.

Soja max (L.) Piper—Northumberland Co.: in outdoor cultivation, Fisher's Ferry, *3120*. Warren Co.: in outdoor cultivation, North Warren, *15940*, verif. Bailey.

Tephrosia virginiana (L.) Pers.—Snyder Co.: in fields at edge of woods, Salem, *3233*, cited as "*Cracca virginiana* L." on page 63 of the Annotated List and so distributed.

Trifolium agrarium L.—Warren Co.: in sunny grassy fields, North Warren, *15263*, *17865*; in grassy fields between Irvington and Tideoute, *17507*.

Trifolium dubium Sibth.—Warren Co.: in lawns, North Warren, *15221*.

Trifolium hybridum L.—Snyder Co.: in waste and cultivated ground and along roadsides near Bake Oven Hill, Selinsgrove, *2405*. Warren Co.: in waste and cultivated ground and pastures, North Warren, *14871*.

Trifolium hybridum f. **albiflorum** Moldenke, f. nov.—Haec forma a forma typica speciei corollis albis recedit. This form differs from the typical form of the species in having its corollas completely white. The type (no. *17580*) was collected in a meadow along the Conewango Creek between North Warren and Russell on July 4, 1945.

Trifolium pratense L.—Warren Co.: in waste and cultivated ground, lawns, fields, and meadows, North Warren, *14869*, *17770*.

Trifolium pratense var. *albiflorum* Pluskal—Warren Co.: in grassy railroad right-of-way, North Warren, *17760*.

Trifolium repens L.—Snyder Co.: in lawns and cultivated ground, Selinsgrove, *2360*. Warren Co.: in lawns, waste and cultivated ground, and fields, North Warren, *14870*.

Vicia americana Muhl.—Centre Co.: in grassy fields near Penn's Cave, Centerville, *2481*. Warren Co.: along margins of wood roads and on roadside banks, North Warren, *14890*, *15790*.

Vicia caroliniana Walt.—Snyder Co.: in moist grassy fields, Selinsgrove, *3865*. Warren Co.: in grassy fields and hedgerows, North Warren, *14660*, *16236*, *17384*, det. Stratton; in meadows, near Kinzua, *17234*.

Vicia cracca L.—Snyder Co.: in grassy fields and hedgerows, Selinsgrove, *2858*. Warren Co.: in grassy fields, Warpen Park, and on banks, Warren, *14530*, *16337*; in fields and along dry roadside ditches, North Warren, *15456*; in grassy meadows along Conewango Creek between North Warren and Russell, *17572*; in grassy fields, Bull Hill, Sheffield, *17724*.

Wisteria floribunda (Willd.) P. DC.—Warren Co.: in outdoor cultivation, seedlings becoming weeds in cultivated ground, North Warren, *16548*, verif. Bailey.

Wisteria macrostachya Nutt.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3202*, cited as "*Kraunhia macrostachys* (T. & G.) Small" on page 63 of the Annotated List and so distributed.

HAMAMELIDACEAE

Hamamelis virginiana L.—Warren Co.: in outdoor cultivation, in woodlands, and along margins of wood roads, North Warren, *14983*, verif. Bailey, *15477*.

BUXACEAE

Buxus sempervirens L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2330*.

Buxus sempervirens var. *myrtifolia* (Lam.) Loud.—Warren Co.: in indoor cultivation, North Warren, *14945*, verif. Bailey.

PLATANACEAE

Platanus acerifolia (Ait.) Willd.—Snyder Co.: common in cultivation as a street tree, Selinsgrove, *2391*, cited as "*P. acerifolia* Willd." on page 67 of the Annotated List and so distributed.

Platanus occidentalis L.—Snyder Co.: along banks of Penn's Creek, Penn Avon, *2817*. Warren Co.: in outdoor cultivation and in moist ground along margins of streams and lakes, North Warren, *14884*, verif. Bailey.

SALICACEAE

Populus alba L.—Forest Co.: along roadsides, Tionesta Dam, *16802*. Snyder Co.: along roadsides and fencerows, also cultivated, Selinsgrove, *2273*.

Populus canadensis Moench—Warren Co.: in cultivation as roadside trees, North Warren, *15804*, verif. Rehder.

Populus canadensis var. *eugenei* (Simon-Louis) Schelle—Warren Co.: in cultivation along roadsides, North Warren, *17120*.

Populus candicans Ait.—Westmoreland Co.: in outdoor cultivation, Latrobe, *2831*.

Populus deltoides Marsh.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2286*.

Populus grandidentata Michx.—Snyder Co.: in woodlands, Selinsgrove, *2272*. Warren Co.: on cut-over hillsides and along fences, Warren, *14763*; in woodlands and along margins of woods, North Warren, *15664*, *15842*.

Populus nigra var. *italica* Muenchh.—Snyder Co.: common in outdoor cultivation, Selinsgrove, *2424*, cited as "var. *italica* Du Roi" on page 67 of the Annotated List and so distributed.

Populus tremuloides Michx.—Warren Co.: on cut-over hillsides, Warren, *14811*; along roadsides and margins of woods, North Warren, *15422*.

Salix babylonica L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2285*, *3207*. Warren Co.: in outdoor cultivation, North Warren, *16232*, *16580*, verif. Bailey.

Salix bebbiana Sarg.—Warren Co.: at edge of swamp, North Warren, *16268*. det. Ball.

Salix caprea var. *pendula* T. Lang—Snyder Co.: in outdoor cultivation, Selinsgrove, *3825*, cited as "var. *pendula* Hort." on page 67 of the Annotated List and so distributed.

Salix cinerea L.—Warren Co.: in outdoor cultivation, North Warren, *15183*, det. Ball, who says "this is one of the two European species grown for the florists' trade, the other being the very similar *S. caprea*."

Salix cordata Muhl.—Warren Co.: along wood roads, Warren, *14772*, det. Ball, who says "the long cane suggests a mowed plant;" in mud along banks of Conewango Creek, North Warren, *17836*, *17922*.

Salix discolor Muhl.—Forest Co.: in meadows along brook, Tionesta Dam, *16805*. Snyder Co.: along streams and moist fencerows and in outdoor cultivation, Selinsgrove, *2248*. Warren Co.: along edges of wood roads, North Warren, *15668*, det. Ball, who says "this is typical except for the pubescent young twigs. If the pubescence persisted on 1-year and 2-year twigs it would represent var. *eriocephala* (Mx.) And."

Salix elaeagnos Scop.—Warren Co.: in outdoor cultivation, North Warren, *14704*, det. as "*S. incana* Schrank" by Ball, who comments "this is usually a shrub. It is one of the species introduced for basket-making, as well as ornament, but never was as abundant as *S. purpurea* or somewhat common as *S. viminalis*."

Salix fragilis L.—Snyder Co.: overhanging the water along the banks of the Susquehanna River and other streams, Selinsgrove, *2284*. Warren Co.: in outdoor cultivation, Warren, *14549*, det. Ball, *14749*, det. Ball.

Salix humilis Mash.—Warren Co.: along margins of old wood roads, Warren, *14779*, det. Ball, who says "the pistillate flowers are sterile and the oblanceolate leaves are glabrate, perhaps indicating hybridity."

Salix nigra Marsh.—Warren Co.: abundant in moist meadows, North Warren, *16645*, verif. Ball.

MYRICACEAE

Cerothamnus pensylvanicus (Loisel.) Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15292*, verif. Bailey.

Comptonia peregrina (L.) Coulter—Potter Co.: in open woods, Coudersport, *17543*. Warren Co.: in clearings in dry open woodlands, North Warren, *15816*, *16616*.

BETULACEAE

Alnus rugosa (Du Roi) Spreng.—Snyder Co.: along margins of Penn's Creek, Selinsgrove, *2794*.

Betula lenta L.—Lackawanna Co.: in woods on Bald Mountain, Scranton, *6507*. Northumberland Co.: in woods on Montour Ridge, Northumberland, *2401*. Warren Co.: in woodlands, North Warren, *15848*; in woodland 1 mile southwest of Sheffield, *17009*.

Betula lutea Michx. f.—Monroe Co.: in woods, Buck Hill Falls, *3007*. Warren Co.: in outdoor cultivation and in woodlands, North Warren, *14697*, verif. Bailey.

Betula nigra L.—Snyder Co.: along banks of the Susquehanna River and in outdoor cultivation, Selinsgrove, *2302*. Warren Co.: along banks of the Allegheny River, Warren, *17440*.

Betula papyrifera Marsh.—Northumberland Co.: in woods near the summit of Mt. Mahanoy, alt. about 1,500 feet, Herndon, *3118*. Warren Co.: in outdoor cultivation, North Warren, *16217*.

Betula pendula var. *gracilis* Rehd.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2470*.

Betula populifolia Marsh.—Lackawanna Co.: in dark woods, Scranton, *6496*. Warren Co.: in outdoor cultivation, North Warren, *15829*, verif. Bailey.

CORYLACEAE

Carpinus caroliniana var. *virginiana* (Marsh.) Fernald—Warren Co.: along margins of woodlands and in open woods, North Warren, *15459*, *15542*.

Corylus americana Marsh.—Warren Co.: along fencerows and hedges, North Warren, *15270*.

Corylus cornuta Marsh.—Clinton Co.: in thickets, Lock Haven, *3541*, distributed as "C. *rostrata* Ait."

Ostrya virginiana (Mill.) Willd.—Snyder Co.: along edge of Penn's Creek, Penn Avon, *2406*.

FAGACEAE

Castanea dentata (Marsh.) Borkh.—Indiana Co.: in fields, Marion Center, *3367*. Warren Co.: in woodlands, North Warren, *15472*.

Fagus grandifolia Ehrh.—Snyder Co.: in woods and also cultivated as a street tree, Selinsgrove, *2409*, distributed as "*F. americana* Sweet."

Fagus sylvatica var. *atropunicea* West.—Warren Co.: in outdoor cultivation, North Warren, *14748*, verif. Bailey.

Fagus sylvatica var. *laciniata* Vignet—Luzerne Co.: in outdoor cultivation, Wilkes-Barre, *3569*, cited as "var. *heterophylla* Loud." on page 69 of the Annotated List and so distributed.

Fagus sylvatica var. *pendula* Loud.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2461*, erroneously cited as "var. *pendula* Lodd." on page 69 of the Annotated List and so distributed.

Quercus alba L.—Northumberland Co.: in woods on Montour Ridge, Northumberland, *2399*. Warren Co.: in outdoor cultivation and in woodlands, North Warren, *14618*, verif. Bailey.

Quercus bicolor Willd.—Warren Co.: in outdoor cultivation, Warren, *15045*, det. Rehder.

Quercus borealis Michx. f.—Warren Co.: in outdoor cultivation, North Warren, *14996*, verif. Bailey.

Quercus borealis var. *maxima* (Marsh.) Ashe—Snyder Co.: in woods and along roadsides, Selinsgrove, *2382*, cited as "Q. *rubra* L." on page 69 of the Annotated List and so distributed. Warren Co.: in woodlands and along streams, North Warren, *15382*.

Quercus coccinea Muenchh.—Snyder Co.: in woodlands and in outdoor cultivation, Selinsgrove, *2381*, cited as "Q. *coccinea* Wang." on page 69 of the Annotated List and so distributed.

Quercus ilicifolia Wang.—Snyder Co.: in woods on mountain east of Middle Creek, Selinsgrove, *2825*.

Quercus montana Willd.—Snyder Co.: in woods, Selinsgrove, *2403*.

Quercus palustris Muenchh.—Snyder Co.: in swampy ground and in outdoor cultivation, Selinsgrove, *2471*, cited as "Q. *palustris* Du Roi" on page 69 of the Annotated List and so distributed.

Quercus prinoides Willd.—Warren Co.: in woodlands, North Warren, *15862*, verif. Rehder.

Quercus robur var. *concordia* (Kirchn.) Lem.—Warren Co.: in outdoor cultivation, North Warren, *14740*, verif. Bailey, *14897*, verif. Bailey.

Quercus velutina Lam.—Monroe Co.: in woods, Buck Hill Falls, *2993*. Warren Co.: in light woods along streams, North Warren, *15383*.

Quercus sp.—Warren Co.: along roadside, Warren, *14775*.

ULMACEAE

Celtis occidentalis L.—Snyder Co.: along fencerows and in hedgerows, Selinsgrove, *2808*.

Ulmus americana L.—Snyder Co.: in woods and pastures and along fences, also in outdoor cultivation, Selinsgrove, *2790*. Warren Co.: in cultivation as street and lawn trees and wild in woodlands, North Warren, *15003*, verif. Bailey, *16169*.

Ulmus carpinifolia Ehrh.—Warren Co.: in outdoor cultivation, Warren, *15046*, det. Rehder.

Ulmus fulva Michx.—Potter Co.: in woodlands, Coudersport, *16170*. Warren Co.: in woods and along streams, North Warren, *15381*; seedlings in woods east of Russell, *16836*.

Ulmus glabra f. *camperdownii* (Henry) Rehd.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2798*, *3103*. Both collections were cited as "var. *camperdowni* Rehd." on page 70 of the Annotated List and so distributed.

Ulmus glabra f. *pendula* (Loud.) Rehd.—Warren Co.: in outdoor cultivation, North Warren, *14670*, verif. Bailey.

Ulmus pumila L.—Montgomery Co.: cultivated in farmyard, Pottstown, *11273*. Warren Co.: in outdoor cultivation, North Warren, *15990*, verif. Bailey.

MORACEAE

Broussonetia papyrifera (L.) Vent.—Northumberland Co.: in outdoor cultivation and abundantly escaped along roadsides and fencerows, Fisher's Ferry, *3123*.

Ficus carica L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14715*, verif. Bailey.

Ficus elastica Roxb.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14927*, verif. Bailey.

Ficus elastica var. *variegata* N. Taylor—Warren Co.: in indoor cultivation, North Warren, *14926*, verif. Bailey.

Ficus lyrata Warb.—Warren Co.: in indoor cultivation, North Warren, *14964*, verif. Bailey.

Maclura pomifera (Raf.) Schneid.—Snyder Co.: cultivated to make hedges along fencerows and escaping abundantly, Selinsgrove, *2467*, cited as "*M. pomifera* Schneid." on page 71 of the Annotated List and so distributed.

Morus alba L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3839*. Warren Co.: in outdoor cultivation, North Warren, *15115*, cited as "*M. alba* f. *nigrobacca* Moldenke" on page 18 of the Observed Flora of Warren and so verif. by Bailey, *16340*; in woods on hillside, Washington Park, Warren, *17422*, verif. Rehder.

Morus rubra L.—Snyder Co.: along fencerows adjacent to State highway near Bake Oven Hill, Selinsgrove, *2384*.

URTICACEAE

Boehmeria cylindrica (L.) Sw.—Warren Co.: in moist soil near Conewango Creek and in moist thickets and marshes, North Warren, *15561*, *16778*, *18084*.

Helxine soleirolii Req.—Warren Co.: in indoor cultivation and as weed under greenhouse benches, North Warren, *15831*, verif. Bailey.

Laportea canadensis (L.) Gaud.—Snyder Co.: on rocky banks along Penn's Creek, Penn Avon, *2751*, distributed as "*Urticastrum divaricatum* (L.) Kuntze." Warren Co.: forming colonies in dense moist woods, North Warren, *15501*, *16750*, *18100*; in deep woods, Deerlick road, Sheffield, *17711*.

Pellionia daveauana N. E. Br.—Philadelphia Co.: in indoor cultivation, Philadelphia, *3065*.

Pilea microphylla (L.) Liebm.—Warren Co.: in indoor cultivation, Warren, *14574*, verif. Bailey.

Pilea pumila (L.) A. Gray—Warren Co.: in dense colonies in rich humus of burned-over woodlands near stream and in damp waste ground, North Warren, *15000*, *15438*.

Urtica procera Muhl.—Potter Co.: along fencerows and in waste ground, Coudersport, *16718*, *17541*. Snyder Co.: in waste ground, Selinsgrove, *2745*, distributed as "*U. gracilis* Ait." Warren Co.: in dry fields, in moist ground along Conewango Creek, and along fencerows, North Warren, *16617*, *17689*, *18222*.

CANNABINACEAE

Humulus lupulus L.—Warren Co.: in outdoor cultivation and escaped along railroad tracks and on dumps, Warren, *14810*.

ILICACEAE

Ilex montana T. & G.—Monroe Co.: in rocky woods, Buck Hill Falls, *2988*, cited as "*I. monticola* A. Gray" on page 71 of the Annotated List and so distributed.

Nemopanthus mucronata (L.) Trelease—Potter Co.: in swampy ground, Coudersport, *17028*.

CELASTRACEAE

Celastrus scandens L.—Forest Co.: in dense thickets, Tionesta Fish Hatchery, *16818*. Snyder Co.: climbing into low trees in woodlands and along fences, Selinsgrove, *2852*. Warren Co.: in hedgerows and in outdoor cultivation along fences, North Warren, *14913*, verif. Bailey, *15198*.

Euonymus alata (Thunb.) Sieb.—Dauphin Co.: in outdoor cultivation, Harrisburg, *4586*, cited as "*E. alatus* Regel" on page 72 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *14754*, det. as "*E. alatus*, Sieb." by Bailey.

Euonymus europaea L.—Warren Co.: in outdoor cultivation, North Warren, *16223*, verif. Bailey.

Euonymus fortunei (Turcz.) Hand.-Mazz.—Warren Co.: in outdoor cultivation on walls of houses, Warren, *14480*, verif. Bailey.

Euonymus fortunei f. *gracilis* (Regel) Rehd.—Warren Co.: in outdoor cultivation as miniature hedges and on walls, North Warren, *15052*, verif. Bailey.

Euonymus fortunei var. *radicans* (Miq.) Rehd.—Centre Co.: in outdoor cultivation on walls, State College, *2757*, cited as "*E. radicans* Sieb." on page 72 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation on walls, North Warren, *14733*, verif. Bailey, *15053*, verif. Bailey.

Euonymus fortunei f. *reticulata* (Regel) Rehd.—Warren Co.: in indoor cultivation, North Warren, *16112*, verif. Bailey.

Euonymus japonica L.—Warren Co.: in indoor cultivation, North Warren, *16155*, verif. Bailey.

Euonymus japonica var. *argenteo-variegata* Regel—Warren Co.: in indoor cultivation, North Warren, *16122*, verif. Bailey.

Euonymus japonica var. *medio-picta* Rehd.—Warren Co.: in indoor cultivation, North Warren, *16121*, verif. Bailey.

Euonymus obovata Nutt.—Clearfield Co.: in woodlands, Du Bois, *3847*, cited as "*E. obovatus* Nutt." on page 72 of the Annotated List and so distributed. Warren Co.: in dense woods, Cranbrook Farm, North Warren, *17295;* in damp woods near Sheffield, *18203*.

SANTALACEAE

Comandra umbellata (L.) Nutt.—Snyder Co.: in fields at edge of woodland, Selinsgrove, *3188*. Warren Co.: along margins of old wood roads, Warren, *14807;* in open woods, near Sheffield, *17415*.

RHAMNACEAE

Ceanothus americanus L.—Forest Co.: in thickets along Tionesta Creek from Henry's Mills to Kelletville, *17619*. Warren Co.: in open woods and along old wood roads, North Warren, *15663*, *17677*, *17869;* at edge of wood road between Irvington and Tideoute, *17477*.

VITACEAE

Cissus rhombifolia Planch.—Warren Co.: in indoor cultivation, North Warren, *16105*, verif. Bailey.

Parthenocissus quinquefolia (L.) Planch.—Warren Co.: trailing on railroad embankments and climbing in hedgerows and along fences, North Warren, *15356*, cited as "f. *hirsuta* (Donn.) Fernald" on page 19 of the Observed Flora of Warren.

Parthenocissus tricuspidata (Sieb. & Zucc.) Planch.—Warren Co.: in outdoor cultivation on walls, the seedlings abundant as weeds in cultivated ground and waste soil, North Warren, *15217*, verif. Bailey.

Vitis aestivalis Michx.—Snyder Co.: in hedge along roadside, Selinsgrove, *3887*.

Vitis labrusca L.—Warren Co.: climbing over shrubs and into trees along Conewango Creek, North Warren, *15376*.

Vitis labruscana L. H. Bailey—Warren Co.: in outdoor cultivation on trellises and escaped along fences and hedges, North Warren, *15107*, *15293*, verif. Bailey.

Vitis riparia Michx.—Warren Co.: along fencerows and hedges, Warren, *14780*; on banks of streams, North Warren, *15375*.

Vitis vinifera var. *sylvestris* Willd.—Warren Co.: growing along walls from seeds thrown out of windows, North Warren, *15988*.

RUTACEAE

Phellodendron amurense Rupr.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3551*.

Ruta graveolens L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3228*.

AURANTIACEAE

Citrus aurantium L.—Warren Co.: in indoor cultivation, North Warren, *16153*, verif. Bailey.

Citrus limonia Osbeck—Warren Co.: in indoor cultivation, North Warren, *16152*, verif. Bailey.

Citrus maxima (Burm.) E. D. Merr.—Warren Co.: in indoor cultivation, North Warren, *14956*, verif. Bailey.

Citrus sinensis Osbeck—Susquehanna Co.: in indoor cultivation, Hop Bottom, *2781*.

Citrus taitensis Risso—Potter Co.: in indoor cultivation, Coudersport, *16167*, verif. Bailey.

SIMARUBACEAE

Ailanthus altissima (Mill.) Swingle—Dauphin Co.: along roadsides, Harrisburg, *10076*.

SAPINDACEAE

Koelreuteria paniculata Laxm.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3559*.

AESCULACEAE

Aesculus arguta Buckl.—Columbia Co.: in cultivation as a street tree, Bloomsburg, *2442*.

Aesculus hippocastanum L.—Snyder Co.: in outdoor cultivation and seedlings widely escaped, Selinsgrove, *2493*. Warren Co.: in outdoor cultivation and escaped, North Warren, *15145*, verif. Bailey.

Aesculus parviflora Walt.—Warren Co.: in outdoor cultivation, North Warren, *15294*, verif. Bailey.

Aesculus pavia L.—Snyder Co.: in cultivation as a street tree, Selinsgrove, *2372*.

ACERACEAE

Acer palmatum f. *atropurpureum* (Van Houtte) Schwer.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3099*, cited as "var. *atropurpureum* Van Houtte" on page 74 of the Annotated List and so distributed.

Acer pensylvanicum L.—Snyder Co.: in woods on steep mountainside along Middle Creek, Selinsgrove, *2466*, cited as "*A. pennsylvanicum*" on page 74 of the Annotated List and so distributed. Warren Co.: in open woods, Willow Street Run, Sheffield, *18106*.

Acer platanoides L.—Snyder Co.: in outdoor cultivation, the seedlings becoming weeds in lawns and cultivated ground, Selinsgrove, *2268*. Warren Co.: in outdoor cultivation, the seedlings becoming weeds in lawns, hedges, and cultivated ground, North Warren, *14879*, verif. Bailey, *16741*, *17198*. The twigs are often infested with the eggs of lace-wing flies or aphis-lions (*Chrysopidae*), fide Stevenson.

Acer platanoides var. *schwedleri* Nichols.—Warren Co.: in outdoor cultivation, North Warren, *14688*, verif. Bailey.

Acer pseudoplatanus L.—Snyder Co.: in outdoor cultivation, seedlings tending to escape, Selinsgrove, *2386*.

Acer spicatum Lam.—Northumberland Co.: in woods on Montour Ridge, Northumberland, *2400*.

Argentacer saccharinum (L.) Small—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *2240*, distributed as "*Acer saccharinum* L." Warren Co.: in outdoor cultivation, in thickets, along hedgerows, and on stream banks, North Warren, *14893*, verif. Bailey; in open woods, Willow Street Run, Sheffield, *18107*.

Argentacer saccharinum var. *laciniatum* (Carr.) Moldenke—Snyder Co.: in outdoor cultivation, Selinsgrove, *2867*, cited as "var. *weiri* (Schwerin) Moldenke" on page 74 of the Annotated List and distributed as "*Acer saccharinum* var. *weiri* Schwerin." Warren Co.: in outdoor cultivation, North Warren, *14972*, verif. Bailey.

Negundo aceroides Moench—Snyder Co.: in woods along canal-bed on Isle of Que, Selinsgrove, *2795*, distributed as "*Acer negundo* L." Warren Co.: along streams, North Warren, *14889*.

Rufacer carolinianum (Walt.) Small—Snyder Co.: in outdoor cultivation along roadsides, Selinsgrove, *2789*, distributed as "*Acer carolinianum* Walt.," *7894*, distributed as "*A. rubrum* var. *tridens* Wood."

Rufacer rubrum (L.) Small—Snyder Co.: in woodlands, along streams, and in outdoor cultivation, Selinsgrove, *2247*, distributed as "*Acer rubrum* L." Warren Co.: in woods and moist soil along streams and in outdoor cultivation, North Warren, *15622*, verif. Bailey.

Saccharodendron saccharum (Marsh.) Moldenke—Snyder Co.: in outdoor cultivation, Selinsgrove, *2846*, distributed as "*Acer saccharum* Marsh." Warren Co.: in woodlands and in outdoor cultivation, North Warren, *14669*, verif. Bailey, *17199*.

STAPHYLEACEAE

Staphylea trifolia L.—Northumberland Co.: in woods at base of Mt. Mahanoy, Herndon, *2368*.

ANACARDIACEAE

Cotinus coggygria Scop.—Warren Co.: in outdoor cultivation, North Warren, *14745*, verif. Bailey, *15138*, verif. Bailey.

Rhus copallinum var. *latifolia* Engl.—Warren Co.: in thickets along wood roads between Sheffield and Brookston, *18126*.

Rhus glabra L.—Warren Co.: along fencerows and borders of fields, North Warren, *15543*, *16547*.

Rhus typhina Torner—Warren Co.: along roadsides, in hedgerows, and in outdoor cultivation, North Warren, *15044*, verif. Bailey, *15278*.

Rhus typhina f. *dissecta* Rehd.—Warren Co.: in outdoor cultivation, North Warren, *15147*, verif. Bailey.

Toxicodendron radicans (L.) Kuntze—Snyder Co.: in thickets, hedgerows, and along fences, Selinsgrove, *2549*. Warren Co.: in margins of woods, along fences, and on walls, North Warren, *15975*.

JUGLANDACEAE

Carya cordiformis (Wang.) K. Koch—Snyder Co.: along edge of Middle Creek at the "Swinging Bridge," Selinsgrove, *3100*, cited as "*Hicoria cordiformis* (Wang.) Britton" on page 75 of the Annotated List and so distributed.

Carya glabra (Mill.) Sweet—Warren Co.: in woodlands, North Warren, *15845*.

Carya laciniosa (Michx. f.) Loud.—Snyder Co.: along edge of Penn's Creek, Penn Avon, *2832*, cited as "*Hicoria laciniosa* (Michx. f.) Sarg." on page 75 of the Annotated List and so distributed.

Carya ovalis (Wang.) Sarg.—Snyder Co.: in field along fencerow, Selinsgrove, *3125*, cited as "*Hicoria microcarpa* (Nutt.) Britton" on page 75 of the Annotated List and so distributed.

Carya ovata (Mill.) K. Koch—Snyder Co.: along banks of Middle Creek, Selinsgrove, *2429*, cited as "*Hicoria ovata* (Mill.) Britton" on page 75 of the Annotated List and so distributed. Warren Co.: in woodlands, North Warren, *15574*.

Carya tomentosa (Lam.) Nutt.—Snyder Co.: in woodlands and in outdoor cultivation, Selinsgrove, *2759*, cited as "*Hicoria alba* (Mill.) Britton" on page 75 of the Annotated List and so distributed.

Juglans sieboldiana Maxim.—Snyder Co.: in outdoor cultivation, Selinsgrove, *1987*.

Wallia cinerea (L.) Alef.—Monroe Co.: in woods, Buck Hill Falls, *2907*, det as "*Juglans cinerea* L." by Lewis and so distributed. Warren Co.: in outdoor cultivation and in woodlands, North Warren, *16522*, verif. Bailey.

Wallia nigra (L.) Alef.—Warren Co.: in outdoor cultivation and in woodlands, often infested with erineum or erinose due to insects or mites, possibly *Eriophyes acaulis* (fide Stevenson), North Warren, *14875*, verif. Bailey, *15180*, verif. Bailey, *16551*.

CORNACEAE

Benthamidia florida (L.) Spach—Snyder Co.: in woods on slope of Bake Oven Hill, Selinsgrove, *2350*, distributed as "*Cynoxylon floridum* (L.) Raf." Warren Co.: in open woodlands, along margins of woods, and in outdoor cultivation, North Warren, *15786*.

Chamaepericlymenum canadense (L.) Aschers. & Graebn.—Centre Co.: in woods at Bear Meadows, Tusseyville, *2484*. Potter Co.: in dense woodlands, Coudersport, *17030*. Warren Co.: in open woods, Sandstone Springs, *17603*.

Cornus mas L.—Warren Co.: in outdoor cultivation, North Warren, *15159*, verif. Bailey, *16177*, verif. Bailey.

Svida alternifolia (L. f.) Small—Monroe Co.: in woods, Buck Hill Falls, *2974*, distributed as "*Cornus alternifolia* L. f." Potter Co.: along margins of streams, Coudersport, *17531*. Warren Co.: in outdoor cultivation, North Warren, *15223*, det. as "*Cornus alternifolia* L." by Rehder, *16257*, verif. Bailey.

Svida amomum (Mill.) Small—Lackawanna Co.: in woods on Bald Mountain, Scranton, *6506*, distributed as "*Cornus amomum* Mill." Warren Co.: in thickets near Conewango Creek, North Warren, *15558*, *16381*. The two last-mentioned collections were det. as "*Cornus amomum* Mill." by Rehder, who says of *16381* "it differs in the presence of bracts on the inflorescence and also in the absence of the brownish pubescence of the veins which is rather typical for the species. The bracts of the inflorescence are certainly unusual; in the herbarium I could find no single specimen of *C. amomum* or among the related species with a bracted inflorescence."

Svida obliqua (Raf.) Moldenke—Warren Co.: in outdoor cultivation and naturalized in large thickets at edge of Conewango Creek, North Warren, *15031*, *15181*, det. as "*Cornus alba*, L." by Bailey, *15182*, *16588*, *16589*, *17978*; in outdoor cultivation, Warren, *14839*. All these collections were det. as "*Cornus obliqua* Raf." by Rehder.

Svida racemosa (Lam.) Moldenke—Warren Co.: forming dense colonies at edge of thickets and woodlands and along borders of wood roads, North Warren, *15594*, *15865*, *16768*; in hedgerows between Irvington and Tideoute, *17500*; in thickets along Conewango Creek between North Warren and Russell, *17561*. Wyoming Co.: in hedgerows, south of Lovelton, *17545*. The first two of these collections were det. as "*Cornus racemosa* Lam." by Rehder.

Svida rugosa (Lam.) Rydb.—Monroe Co.: in woods along trails, Buck Hill Falls, *2975*, distributed as "*Cornus rugosa* Lam." Warren Co.: in woodlands, North Warren, *15575*.

NYSSACEAE

Nyssa sylvatica Marsh.—Warren Co.: along margins of wood roads, North Warren, *15419*.

ARALIACEAE

Acanthopanax sieboldianus Mak.—Warren Co.: in outdoor cultivation, North Warren, *15049*, verif. Bailey.

Aralia chinensis L.—Warren Co.: in outdoor cultivation and spreading by roots, North Warren, *15828*, verif. Bailey.

Aralia hispida Vent.—Monroe Co.: in damp woods along trails, Buck Hill Falls, *2976*. Potter Co.: in woods at edge of cliff, Coudersport, *16403*.

Aralia nudicaulis L.—Snyder Co.: in woods and thickets along Middle Creek, Selinsgrove, *2395*. Warren Co.: in dense dark woodlands, North Warren, *15537*.

Aralia racemosa L.—Monroe Co.: in woods along trails, Buck Hill Falls, *2977*. Warren Co.: at edge of woods and along old wood roads, North Warren, *15355*, *15665*.

Aralia spinosa L.—Potter Co.: at margins of woods, Coudersport, *17029*.

Hedera canariensis var. *variegata* Schulze—Warren Co.: in indoor cultivation, North Warren, *14930*, det. Bailey.

Hedera helix L.—Snyder Co.: in outdoor cultivation on walls, Selinsgrove, *2458*. Warren Co.: in indoor and outdoor cultivation, North Warren, *16114*, verif. Bailey.

Hedera helix var. *Pittsburgh* Lawrence & Schulze—Warren Co.: in indoor cultivation and summer outdoor cultivation, North Warren, *15068*, det. Bailey.

Panax quinquefolium L.—Monroe Co.: in rocky wood garden of Mrs. George W. Stratton, Buck Hill Falls, *3000*.

Panax trifolium L.—Perry Co.: in woods, Blain, *2814*. Warren Co.: in moist woods, Warren, *14489*; in dense woods, Deerlick road, near Sheffield, *17282*.

AMMIACEAE

Aegopodium podograria var. *variegatum* L. H. Bailey—Snyder Co.: in outdoor cultivation, becoming weedy, Selinsgrove, *2542*, cited as "var. *variegatum* Hort." on page 76 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation and escaped, North Warren, *15290*, verif. Bailey.

Anethum graveolens L.—Warren Co.: in outdoor cultivation, North Warren, *17989*.

Angelica atropurpurea L.—Warren Co.: in moist ground along roadside ditches, North Warren, *15584*, verif. Constance; in moist meadows between Irvington and Tideoute, *17503*.

Angelica venenosa (Greenw.) Fernald—Warren Co.: in woods and along margins of wood roads, North Warren, *15455*, det. Constance, *17700*, *17860*.

Apium graveolens var. *dulce* (Mill.) P. DC.—Warren Co.: in outdoor cultivation, North Warren, *15620*, verif. Constance, inaccurately listed as "var. *dulce* P. DC." on page 20 of the Observed Flora of Warren.

Apium graveolens var. *rapaceum* (Mill.) P. DC.—Warren Co.: in outdoor cultivation, North Warren, *15981*, verif. Bailey.

Bupleurum rotundifolium L.—Lycoming Co.: in waste and cultivated ground, Jersey Shore, *2109*.

Carum carvi L.—Lackawanna Co.: in waste ground, Scranton, *6501*. Potter Co.: naturalized in fields, Coudersport, *16407*.

Chaerophyllum procumbens (L.) Crantz—Snyder Co.: along banks of Middle Creek, Selinsgrove, *2809*.

Cicuta bulbifera L.—Warren Co.: in marshes, North Warren, *16823*.

Cicuta maculata L.—Snyder Co.: along edge of Penn's Creek, Selinsgrove, *3010*. Warren Co.: in marshes and along edges of streams, North Warren, *15210*, verif. Constance, *15783*, verif. Constance, *16466*; in marshes, Sheffield, *17855*.

Conium maculatum L.—Snyder Co.: in wet meadows along Penn's Creek, Selinsgrove, *3873*.

Cryptotaenia canadensis (L.) P. DC.—Warren Co.: in moist woods and along borders of wood roads, North Warren, *15344*, verif. Constance, *17687*; in damp woods between Irvington and Tideoute, *17521*.

Daucus carota L.—Potter Co.: in dry fields, Coudersport, *16690*. Warren Co.: in grassy fields, waste and cultivated ground, and along roadsides, North Warren, *15153*, verif. Constance, *17803*, *17927*.

Daucus carota f. *epurpurata* Farwell—Potter Co.: in dry grassy fields, Coudersport, *16557*. Warren Co.: in grassy fields, North Warren, *15497*, verif. Constance, *17804*.

Daucus carota var. *sativa* P. DC.—Warren Co.: in outdoor cultivation, North Warren, *15633*, verif. Constance.

Eryngium amethystinum L.—Warren Co.: in outdoor cultivation, North Warren, *16583*, verif. Bailey.

Eryngium planum L.—Warren Co.: abundantly naturalized in grassy fields, Sheffield, *17845*, det Bailey, who says "according to Mathias & Constance, Am. Midland Nat. **25**:381. 1941, it was introduced from Europe at Salem, Ore."

Foeniculum vulgare Hill—Warren Co.: in outdoor cultivation, North Warren, *15244*, verif. Constance, *17987*.

Heracleum lanatum Michx.—Snyder Co.: abundant in old canal-bed on Isle of Que, Selinsgrove, *2868*. Warren Co.: in marshy ground near streams, North Warren, *15359*, verif. Constance.

Hydrocotyle americana L.—Snyder Co.: partly submerged among rocks on banks of Penn's Creek, Penn Avon, *2776*.

Imperatoria ostruthium L.—Potter Co.: weed in waste and cultivated ground, Coudersport, *16568*.

Osmorhiza claytoni (Michx.) C. B. Clarke—Warren Co.: in thickets and moist dense woodlands, North Warren, *15678*, det. Constance, distributed as "*O. longistylis* (Torr.) P. DC.", *16383*, *17392*.

Osmorhiza longistylis (Torr.) P. DC.—Snyder Co.: in moist woods along old canal-bed on Isle of Que, Selinsgrove, *2318*, distributed as "*Washingtonia longistylis*" (Torr.) Britton." Warren Co.: in hedgerows and thickets, Warren, *14806*, verif. Constance; in hedges by woodlands, near Sheffield, *17417*.

Pastinaca sativa L.—Warren Co.: in outdoor cultivation, North Warren, *15114*, verif. Bailey.

Pastinaca sativa var. *sylvestris* P. DC.—Potter Co.: in grassy fields, Coudersport, *17538*, verif. Constance. Warren Co.: along roadsides, North Warren, *17408;* in moist meadows between Irvington and Tideoute, *17504*, verif. Constance; in grassy meadows along Conewango Creek between North Warren and Russell, *17582*.

Petroselinum crispum (Mill.) Nym.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16118*, verif. Bailey.

Petroselinum crispum var. *crispum* (Mill.) Airy-Shaw—Warren Co.: in indoor and outdoor cultivation, North Warren, *15012*, verif. Bailey, *15636*, verif. Constance.

Petroselinum crispum var. *tuberosum* (Bernh.) Moldenke—Lackawanna Co.: in indoor cultivation, Scranton, *4234*, distributed as "*P. hortense* var. *radicosum* Bailey."

Sanicula canadensis L.—Warren Co.: in moist woodlands, North Warren, *15839*, verif. Constance, *16382*.

Sanicula marilandica L.—Warren Co.: in dense woodlands, North Warren, *15447*, verif. Constance.

Sium suave Walt.—Snyder Co.: in marshy ground, Selinsgrove, *3868*, distributed as "*S. cicutaefolium* Schrank."

Taenidia integerrima (L.) Drude—Forest Co.: in thickets along Tionesta Creek from Henry's Mills to Kelletville, *17621*. Perry Co.: in dry fields, Blain, *2821*. Warren Co.: on grassy banks at edge of woods, Warren, *14812*, verif. Constance; in woodlands, North Warren, *16235;* in open woods near Sheffield, *17418*.

Thaspium barbinode (Michx.) Nutt.—Snyder Co.: along banks of Penn's Creek, Penn Avon, *3234*.

Zizia aptera (A. Gray) Fernald—Snyder Co.: in moist meadow along Penn's Creek on the Isle of Que, Selinsgrove, *2848*, cited as "*Z. cordata* (Willd.) DC." on page 78 of the Annotated List and so distributed.

Zizia aurea (L.) W. Koch—Snyder Co.: in moist fields along edge of Penn's Creek, Selinsgrove, *3177*. Warren Co.: in moist grassy fields, Warren, *14785*, verif. Constance; in moist meadows about 2 miles west of Warren, *15170*, verif. Constance; in marshy ground along stream in woodland, North Warren, *15670*, verif. Constance; in meadows and along streams, near Kinzua, *17219*.

CLETHRACEAE

Clethra alnifolia L.—Warren Co.: on wooded banks, overhanging Conewango Creek, and in outdoor cultivation, North Warren, *15410*, verif. Bailey, *15820*, verif. Bailey, *16630*.

PYROLACEAE

Pyrola americana Sweet—Warren Co.: in damp woods, Bull Hill, Sheffield, *17741*.
Pyrola elliptica Nutt.—Potter Co.: in hemlock woods, Coudersport, *16573*.

ERICACEAE

Arsenococcus ligustrinus (L.) Small—Lackawanna Co.: on grassy hillslopes, Scranton, *6497*.

Azalea calendulacea Michx.—Warren Co.: in outdoor cultivation, North Warren, *15006*, verif. Bailey.

Azalea nudiflora L.—Snyder Co.: in woods, Selinsgrove, *3159*. Warren Co.: in light woods, Warren, *14531*, *14798*; in outdoor cultivation, North Warren, *14851*, verif. Bailey; in woods, near Sheffield, *17413*.

Azalea obtusa Lindl.—Warren Co.: in indoor cultivation, North Warren, *16004*, verif. Bailey.

Azalea viscosa L.—Warren Co.: in outdoor cultivation, North Warren, *15189*, verif. Bailey.

Azalea viscosa var. *rubescens* (Lodd.) Sweet—Warren Co.: in outdoor cultivation, North Warren, *14849*, det. as "*Rhododendron viscosum*, Torr." by Bailey.

Biltia vaseyi (A. Gray) Small—Snyder Co.: in outdoor cultivation, Selinsgrove, *2356*, cited as "*Azalea vaseyi* Rehd." on page 78 of the Annotated List and so distributed.

Calluna vulgaris L.—Warren Co.: in outdoor cultivation, North Warren, *16191*, verif. Bailey.

Epigaea repens L.—Snyder Co.: in woods on Bake Oven Hill, Selinsgrove, *2300*. Warren Co.: on hillsides, Warren, *14496a*; on hillsides, Russell, *14538*.

Erica vagans L.—Lackawanna Co.: in indoor cultivation, Scranton, *4233*.

Gaultheria procumbens L.—Snyder Co.: in woods, Selinsgrove, *2642*. Warren Co.: in woods, Russell, *14537*; in leaf-mold of moist dense rich woodlands, North Warren, *15479*, *17765*.

Kalmia latifolia L.—Clinton Co.: in open woods northwest of Hammersley Fork, *17548*. Snyder Co.: in woods on Bake Oven Hill, Selinsgrove, *2456*. Warren Co.: in outdoor cultivation, North Warren, *14994*, verif. Bailey; in open woodlands between Irvington and Tideoute, *17479*.

Rhododendron maximum L.—Warren Co.: in dense woodlands and outdoor cultivation, North Warren, *15152*; in woodlands, Warpen Park, Warren, *16336*.

Rhododendron mucronulatum Turcz.—Warren Co.: in outdoor cultivation, North Warren, *17906*.

VACCINIACEAE

Buxella brachycera (Michx.) Small—Perry Co.: in woods on the south side of a rocky ravine 1¼ miles above Amity Hall, on the east bank of the Juniata River, *3127*, *6878*; in ravine 2 miles south of New Bloomfield, *7262*. All these collections were distributed as "*Gaylussacia brachycera* (Michx.) A. Gray."

Cyanococcus angustifolius var. *laevifolius* (House) Moldenke—Snyder Co.: on dry sunny hilltops, Selinsgrove, *3140*, cited as "*C. pennsylvanicus* (Lam.) Rydb." on page 79 of the Annotated List and distributed as "*Vaccinium pennsylvanicum* Lam." Warren Co.: forming very dense low-growing colonies, Warren, *14791*; in dense colonies in open woods, near Kinzua, *17231*; on boulders in dry open woods, North Warren, *17675*.

Cyanococcus vacillans (Kalm) Rydb.—Snyder Co.: on dry hillsides, Selinsgrove, *3168*, cited as "*C. vacillans* (Soland.) Rydb." on page 79 of the Annotated List and distributed as "*Vaccinium vacillans* Soland." Warren Co.: in woodlands, Warren, *14790*, *14813*; in woods, near Kinzua, *17230*.

Decachaena frondosa (L.) T. & G.—Warren Co.: on exposed dry banks along woodland roads, North Warren, *15454*, cited as "*D. dumosa* (L.) T. & G." on page 21 of the Observed Flora of Warren.

Polycodium stamineum (L.) Greene—Snyder Co.: in woods and along fencerows, Selinsgrove, *2847*. Warren Co.: along border of wood roads, North Warren, *15688*.

MONOTROPACEAE

Hypopitys lanuginosa (Michx.) Nutt.—Warren Co.: in dense dark woodlands, North Warren, *15587*.

Monotropa uniflora L.—Potter Co.: in dense woodlands, Coudersport, *16577*. Warren Co.: in moist dense woodlands, North Warren, *15322*, *16501*, *17734*.

GALACACEAE

Galax aphylla L.—Monroe Co.: in wood garden of Mrs. George W. Stratton, Buck Hill Falls, *2989*. This and the following are listed under "*Diapensiaceae*" on page 80 of the Annotated List.

Sherwoodia glalacifolia (T. & G.) House—Monroe Co.: in wood garden of Mrs. George W. Stratton, Buck Hill Falls, *3006*, distributed as "*Shortia galacifolia* T. & G."

EBENACEAE

Diospyros virginiana L.—Snyder Co.: along fences and hedgerows, Selinsgrove, *2495*.

LOGANIACEAE

Buddleja asiatica Lour.—Warren Co. in indoor cultivation, North Warren, *16022*, verif. Bailey.

Buddleja davidi Franch.—Warren Co.: in outdoor cultivation, North Warren, *15518*, verif. Bailey, *16709*, verif. Bailey.

Buddleja davidi var. *veitchiana* (Veitch) Rehd.—Warren Co.: in outdoor cultivation, North Warren, *16710*, verif. Bailey.

OLEACEAE

Chionanthus retusus Lindl. & Paxt.—Warren Co.: in outdoor cultivation, North Warren, *14848*, verif. Bailey, *16255*, verif. Bailey.

Forsythia intermedia Zabel—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *3151*, *3210*. Warren Co.: in outdoor cultivation and escaping in waste and cultivated ground and on dumps, North Warren, *16653*, verif. Bailey.

Forsythia viridissima Lindl.—Warren Co.: in outdoor cultivation, North Warren, *14899*, verif. Bailey.

Fraxinus americana L.—Snyder Co.: in woodlands, pastures, and outdoor cultivation, Selinsgrove, *2805*. Warren Co.: in woods and along edge of Conewango Creek, North Warren, *15374*.

Fraxinus excelsior L.—Warren Co.: escaped and naturalized along banks of the Allegheny River, Warren, *17420*, verif. Rehder.

Fraxinus pensylvanica f. *aucubaefolia* (Jaeg.) Rehd.—Warren Co.: in outdoor cultivation, North Warren, *14755*, *15653*, det. Rehder, det. as "var. *aucubaefolia*, Rehder" by Bailey.

Fraxinus pensylvanica var. *lanceolata* (Borkh.) Sarg.—Perry Co.: in outdoor cultivation, Blain, *3838*, cited as "*F. lanceolata* Borck." on page 81 of the Annotated List and so distributed.

Jasminum mesnyi Hance—Warren Co.: in indoor cultivation, North Warren, *15530*, det. with a question by Rehder.

Ligustrum acutissimum Koehne—Warren Co.: in outdoor cultivation, North Warren, *15530*, det. with a question by Rehder.

Ligustrum amurense Carr.—Warren Co.: in outdoor cultivation, North Warren, *17443*, verif. Rehder.

Ligustrum obtusifolium Sieb. & Zucc.—Warren Co.: in outdoor cultivation and escaped, naturalized in hedgerows and along roadsides, North Warren, *14986*, verif. Bailey, *15213*, *15778*.

Ligustrum obtusifolium var. *regelianum* (Koehne) Rehd.—Potter Co.: in outdoor cultivation, Coudersport, *16659*, det. Rehder.

Ligustrum ovalifolium Hassk.—Snyder Co.: widely cultivated as a hedge, Selinsgrove, *3876*.

Ligustrum vulgare L.—Warren Co.: widely cultivated as a hedge and escaped, North Warren, *14959*, det. Bailey, *14987*, verif. Bailey.

Syringa amurensis (Rupr.) Rupr.—Warren Co.: in outdoor cultivation, North Warren, *15037*, verif. Bailey, *15139*, verif. Bailey.

Syringa josikaea Jacq.—Warren Co.: in outdoor cultivation, Warren, *14821*, verif. Bailey; in outdoor cultivation, North Warren, *16264*, verif. Bailey.

Syringa persica L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2387*.

Syringa persica var. *integrifolia* Vahl—Warren Co.: in outdoor cultivation, North Warren, *14693*, verif. Bailey.

Syringa villosa Vahl—Warren Co.: in outdoor cultivation, North Warren, *14915*, det. Bailey, *16262*, verif. Bailey.

Syringa vulgaris L.—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *2346*. Warren Co.: in outdoor cultivation, persistent, and widely escaped and naturalized, the foliage often heavily infested with *Microsphaera alni*, North Warren, *14614*, verif. Bailey.

Syringa vulgaris var. *alba* West.—Warren Co.: in outdoor cultivation, North Warren, *14668*, verif. Bailey.

Syringa vulgaris var. *plena* Oudin—Warren Co.: in outdoor cultivation, North Warren, *16242*, verif. Bailey.

Syringa vulgaris var. *violacea* Ait.—Warren Co.: in outdoor cultivation, North Warren, *16211*, verif. Bailey.

APOCYNACEAE

Apocynum androsaemifolium L.—Potter Co.: in dry grassy fields, Coudersport, *16572*. Warren Co.: in grassy fields about 2 miles west of Warren, *15164*; in grassy fields, North Warren, *15202*, *15844*, verif. Woodson, *17921*; in grassy fields, Deerlick road, Sheffield, *17718*.

Apocynum cannabinum L.—Warren Co.: in cinders along railroad tracks, North Warren, *16371*.

Apocynum cannabinum var. *glaberrimum* A. DC.—Warren Co.: along dry railroad embankments, in grassy meadows, dry fields, dry creek-beds, and banks of streams, North Warren, *16546*, *16639*, *17667*, *17976*, *17977*.

Apocynum sibiricum Jacq.—Warren Co.: on railroad embankments, North Warren, *15361*, det. Woodson.

Catharanthus roseus (L.) G. Don—Snyder Co.: in outdoor cultivation, Selinsgrove, *2416*, distributed as "*Ammocallis rosea* (L.) Small." Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15076*, verif. Bailey.

Cerbera thevetia L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *16754*, verif. Bailey.

Nerium oleander L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15001*, verif. Bailey.

Trachelospermum jasminoides Lam.—Warren Co.: in indoor cultivation, North Warren, *16146*, det. with a question by Bailey.

Vinca major L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14605*, verif. Bailey, *16023*, verif. Bailey.

Vinca major var. *variegata* Loud.—Warren Co.: in indoor and summer outdoor cultivation, Warren, *14833*, verif. Bailey.

Vinca minor L.—Warren Co.: in outdoor cultivation, North Warren, *16199*, verif. Bailey; naturalized at edge of woods, Chandler's Valley, *17822*.

ASCLEPIADACEAE[11]

Asclepias exaltata (L.) Muhl.—Forest Co.: in open woodlands along Tionesta Creek from Henry's Mills to Kelletville, *17636*. Warren Co.: in deep woods and in moist open woodlands, North Warren, *15369*, *16369*, *17672*.

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11 The *Asclepias curassavica* L. erroneously recorded from Pennsylvania on page 82 of the Annotated List, based on number *3262*, was actually collected in Brazil.

Asclepias incarnata L.—Bedford Co.: in marshy ground, Bedford Springs, *3243*. Forest Co.: in swamp along Tionesta Creek from Henry's Mills to Kelletville, *17644*. Warren Co.: along edges of streams, Warren, *15336*; in marshes, Sheffield, *17851*; in swampy ground near Brookston, *17999*.

Asclepias syriaca L.—Potter Co.: along fencerows, Coudersport, *17027*. Warren Co.: in grassy fields, along fencerows, and along roadsides, North Warren, *15268*, *16337*, *17025*, *17701*.

Asclepias tuberosa L.—Warren Co.: in grassy fields and on an old wood mill site in which the species was once cultivated, Sheffield, *17847*, *17910*.

Hoya carnosa R. Br.—Warren Co.: in indoor cultivation, North Warren, *14951*, verif. Bailey.

Stapelia variegata L.—Warren Co.: in indoor cultivation, North Warren, *15065*, verif. Bailey.

RUBIACEAE

Asperula odorata L.—Warren Co.: in outdoor cultivation and naturalized, North Warren, *14694*, verif. Bailey.

Cephalanthus occidentalis L.—Warren Co.: in marshy ground and along margins of Conewango Creek, North Warren, *15559*, *16541*; in marshes between North Warren and Russell, *17891*.

Galium aparine L.—Warren Co.: in hedgerows and thickets, Warren, *14803*; forming extensive colony in moist soil along edge of Conewango Creek and in waste ground along fencerows, North Warren, *15357*, *17395*.

Galium asprellum Michx.—Forest Co.: in meadows along Tionesta Creek from Henry's Mills to Kelletville, *17633*. Snyder Co.: along roadsides, Selinsgrove, *2855*. Warren Co.: in marshes, North Warren, *16784*.

Galium circaezans Michx.—Snyder Co.: in woods, Salem, *3872*. Warren Co.: in dense woodlands, North Warren, *15601*.

Galium concinnum T. & G.—Warren Co.: in open woods, North Warren, *16673*, *17389*.

Galium lanceolatum (Torr.) Torr.—Warren Co.: in dense woodlands, North Warren, *15602*; in dense woods between Irvington and Tideoute, *17488*.

Galium latifolium Michx.—Warren Co.: in woodlands, Sheffield, *17357*.

Galium mollugo L.—Potter Co.: in fields, Coudersport, *16405*. Warren Co.: in moist swale, Cranbrook Farm, North Warren, *17328*.

Galium obtusum Bigel.—Warren Co. in grassy meadows along Conewango Creek between North Warren and Russell, *17560*.

Galium sylvaticum L.—Warren Co.: in woods, North Warren, *17386*.

Galium tinctorium L.—Warren Co.: in dense woods between Irvington and Tideoute, *17499*; in marshy ground along Conewango Creek, North Warren, *17693*; in hedgerows, Chandler's Valley, *17818*.

Galium triflorum Michx.—Forest Co.: in open woods along Tionesta Creek from Henry's Mills to Kelletville, *17638*. Northumberland Co.: in woods along brook on side of Mt. Mahoney, Herndon, *4187*. Snyder Co.: along roadsides on Isle of Que, Selinsgrove, *2375*, det. Gleason, distributed as "*G. aparine* L." Warren Co.: in dense woodlands, thickets, and margins of wood roads, North Warren, *15338*, *15603*, *17768*.

Gardenia jasminoides Ellis—Warren Co.: in indoor cultivation, North Warren, *16172*, verif. Bailey.

Houstonia caerulea L.—Snyder Co.: in moist fields along road to Bake Oven Hill, Selinsgrove, *2267*, distributed as "*H. coerulea* L." Warren Co.: on roadside banks and in meadows, Russell, *14535*; on mossy rocks and old tennis courts, North Warren, *15713*.

Houstonia caerulea f. *albiflora* Millsp.—Warren Co.: in thickets, Cranbrook Farm, North Warren, *17325*.

Mitchella repens L.—Potter Co.: in evergreen woods, Coudersport, *16400*. Warren Co.: in dense woodlands and evergreen groves, North Warren, *15696*, *16678*; in woodlands, Deerlick, near Sheffield, *16321*.

Sherardia arvensis L.—Warren Co.: weed in grassy lawns, North Warren, *15144*.

CAPRIFOLIACEAE

Abelia grandiflora Rehd.—Warren Co.: in indoor cultivation, North Warren, *15216*, verif. Bailey.

Diervilla lonicera Mill.—Potter Co.: at edge of woods, Coudersport, *16388*, *16408*. Warren Co.: in thickets, at edge of woods, and along margins of old wood roads, North Warren, *15194*, *15351*, *16432*; in woodlands, Deerlick, near Sheffield, *16310*; in woodlands between Sheffield and Blue Jay, along the Tionesta Creek, *17594*.

Kolkwitzia amabilis Graebn.—Warren Co.: in outdoor cultivation, North Warren, *14935*, verif. Bailey.

Lonicera dioica L.—Snyder Co.: in woods on hilltop overlooking Middle Creek, Selinsgrove, *2376*. Warren Co.: in woods along old wood roads, Warren, *14781*; in woodlands, at margins of woods, and along old wood roads, North Warren, *15704*, *16495*, *17763*; in woods, Cranbrook Farm, North Warren, *17294*.

Nintooa japonica (Thunb.) Sweet—Warren Co.: in outdoor cultivation and widely naturalized, North Warren, *15760*, verif. Bailey.

Nintooa japonica var. *aureo-reticulata* (T. Moore) Moldenke—Warren Co.: in indoor and outdoor cultivation and spreading as weed in rock gardens, North Warren, *15413*, verif. Bailey.

Sambucus canadensis L.—Warren Co.: in moist swales, along fences, and in outdoor cultivation, North Warren, *15050*, verif. Bailey, *15206*, *17685*.

Sambucus pubens Michx.—Snyder Co.: in woods, Troxelville, *2354*. Warren Co.: in outdoor cultivation, North Warren, *14582*, det. Bailey; at edge of thickets along Four Mile Creek, *18043*.

Symphoricarpos mollis Nutt.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4526*.

Symphoricarpos orbiculatus Moench—Warren Co.: in outdoor cultivation, North Warren, *17831*.

Symphoricarpos rivularis Suksd.—Warren Co.: in outdoor cultivation, escaped, and naturalized in clearing in woods, North Warren, *14939*, det. as "*S. albus* var. *laevigatus*, Blake" by Bailey, *17666*.

Triosteum aurantiacum Bicknell—Warren Co.: along edge of woods, North Warren, *15490*.

Viburnum acerifolium L.—Lackawanna Co.: in woods on Bald Mountain, Scranton, *6503*. Potter Co.: in woodlands, Coudersport, *17530*. Warren Co.: in dense woods, North Warren, *15572*; at edge of woods, Sheffield, *17353*.

Viburnum alnifolium Marsh.—Potter Co.: in woodlands, Coudersport, *16289*. Snyder Co.: in outdoor cultivation, Selinsgrove, *2436*, cited as "*V. lantanoides* Michx." on page 84 of the Annotated List. Warren Co.: in woodlands, North Warren, *14681*; in woodlands, near Kinzua, *17209*.

Viburnum dentatum L.—Wyoming Co.: at margins of woods, south of Lovelton, *17546*.

Viburnum lentago L.—Northumberland Co.: overhanging stream along road to Montour Ridge, Northumberland, *2397*.

Viburnum opulus L.—Warren Co.: in outdoor cultivation, North Warren, *14896*, verif. Bailey.

Viburnum opulus var. *nanum* David—Warren Co.: in outdoor cultivation, North Warren, *14594*, verif. Bailey.

Viburnum opulus var. *roseum* L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2863*, cited as "var. *sterile* DC." on page 84 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *14853*, verif. Bailey.

Viburnum prunifolium L.—Snyder Co.: in woods, Selinsgrove, *2413*.

Viburnum tomentosum Thunb.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2856*.

Viburnum tomentosum var. *sterile* K. Koch—Snyder Co.: in outdoor cultivation, Selinsgrove, *2410*, cited as "var. *plicatum* Maxim." on page 84 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, Warren, *14825*, verif. Bailey.

Viburnum trilobum Marsh.—Warren Co.: along margins of woods and in outdoor cultivation, North Warren, *14695*, verif. Bailey, *15386*.

Weigela florida (Sieb. & Zucc.) A. DC.—Snyder Co.: in outdoor cultivation, Sel-

insgrove, *2422*, cited as "*W. amabilis* Hort." on page 84 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *14846*, verif. Bailey.

Weigela florida var. *variegata* (Bean) L. H. Bailey—Snyder Co.: in outdoor cultivation, Selinsgrove, *2411*, cited as "*W. hybrida* var. *nana* f. *variegata* Hort." on page 84 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *14701*, verif. Bailey.

Weigela hortensis var. *nivea* Bonard—Warren Co.: in outdoor cultivation, North Warren, *15025*, verif. Bailey.

Weigela japonica Thunb.—Warren Co.: in outdoor cultivation, North Warren, *14883*, verif. Bailey.

Xylosteon canadense (Marsh.) Duham.—Potter Co.: in woods, Coudersport, *16277*. Warren Co.: in dense woods, Deerlick road, near Sheffield, *17280*.

Xylosteon dumetorum Moench—Warren Co.: in outdoor cultivation, North Warren, tending to escape, *14747*, det. as "*Lonicera xylosteum*, L." by Bailey.

Xylosteon tataricum (L.) Medic.—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *2355*, distributed as "*Lonicera tatarica* L." Warren Co.: in outdoor cultivation and escaped, North Warren, *14613*, verif. Bailey.

VALERIANACEAE

Centranthus ruber P. DC.—Warren Co.: in outdoor cultivation, North Warren, *15099*, verif. Bailey.

Valeriana officinalis L.—Monroe Co.: in outdoor cultivation, Buck Hill Falls, *2967*. Warren Co.: in outdoor cultivation, becoming weedy, North Warren, *14914*, verif. Bailey.

Valerianella locusta (L.) Bettke—Snyder Co.: in moist meadows along roadside on Isle of Que, Selinsgrove, *2373*.

Valerianella radiata (L.) Dufr.—Snyder Co.: in moist meadows along roadside near Bake Oven Hill, Selinsgrove, *2374*.

DIPSACACEAE

Dipsacus sylvestris Huds.—Warren Co.: in waste ground and along roadsides, Warren, *15328*.

Scabiosa atropurpurea L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *15129*, verif. Bailey.

Succisa australis (Wulf.) Reichenb.—Warren Co.: in marshy ground and moist meadows, North Warren, *16641*, *16772*.

CICHORIACEAE

Cichorium endivia L.—Lackawanna Co.: in indoor cultivation, Scranton, *4229*.

Cichorium intybus L.—Potter Co.: in dry grassy fields, Coudersport, *16556*. Warren Co.: along roadsides and in grassy fields, North Warren, *15493*, *17923*.

Crepis capillaris (L.) Wallr.—Warren Co.: in grassy fields, North Warren, *15838*.

Hieracium aurantiacum L.—Forest Co.: in grassy fields along Tionesta Creek from Henry's Mills to Kelletville, *17650*. Potter Co.: in grassy fields, Coudersport, *16389*. Warren Co.: in waste and cultivated ground, North Warren, *14880*.

Hieracium gronovii L.—Warren Co.: in woodlands, North Warren, *15798*.

Hieracium paniculatum L.—Warren Co.: in open woodlands, North Warren, *15350*, *16668*, *17767*; in open woods, Willow Street Run, Sheffield, *18110*.

Hieracium pratense Tausch—Potter Co.: in grassy fields, Coudersport, *16390*. Warren Co.: in waste ground and fields, North Warren, *14881*; in fields, Deerlick, near Sheffield, *16305*; in grassy fields along Conewango Creek between North Warren and Russell, *17568*.

Hieracium scabrum Michx.—Warren Co.: in dense woodlands, North Warren, *15705*, *16667*; in open woods, Willow Street Run, Sheffield, *18124*.

Hieracium venosum L.—Snyder Co.: in fields, along roadsides, and in woodlands, Port Treverton, *2445*. Warren Co.: on banks at margins of woodland roads, North Warren, *15451*.

Hypochaeris radicata L.—Warren Co.: in waste ground, lawns, and along grassy roadsides, North Warren, *15113*, verif. Stebbins, *17757*.

Lactuca biennis (Moench) Fernald—Warren Co.: along roadsides and fencerows, North Warren, *15596*.

Lactuca canadensis L.—Warren Co.: along wooded roadsides, hedges, and in sunny waste ground, North Warren, *15485*, *17866*.

Lactuca sativa L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *14872*, verif. Bailey, *15928*, verif. Bailey.

Lactuca sativa var. *capitata* L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4211*.

Lactuca sativa var. *crispa* L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4212*.

Lactuca scariola L.—Snyder Co.: along roadsides, fences, and in waste places, Penn Avon, *2747*, cited as "*L. virosa* L." on page 86 of the Annotated List and so distributed.

Lactuca scariola var. *integrata* Gren. & Godr.—Warren Co.: in waste ground and along roadsides, North Warren, *15524*, *15771*, *17918*.

Prenanthes altissima L.—Warren Co.: in damp open woods and along margins of wood roads, North Warren, *15708*, *15709*, *16484*, *16627*, *16757*; in open woods along Four Mile Creek, *18057*, *18058*.

Sonchus arvensis L.—Warren Co.: in grassy fields and waste ground, North Warren, *15770*, *16626*, *17917*.

Sonchus asper (L.) Hill—Warren Co.: in waste and cultivated ground, North Warren, *14841*, *16521*.

Sonchus oleraceus L.—Potter Co.: in waste ground, Coudersport, *16697*. Warren Co.: in waste ground and along roadsides, North Warren, *15647*.

Taraxacum palustre var. *vulgare* (Lam.) Fernald—Snyder Co.: in lawns, fields, and waste ground, Selinsgrove, *2239*, cited as "*T. palustre* (Lyons) Lam. & DC." on page 86 of the Annotated List and distributed as "*Leontodon taraxacum* L." Warren Co.: in lawns and along roadsides, North Warren, *14597*.

Tragopogon porrifolius L.—Warren Co.: in waste ground, North Warren, *14845*.

Tragopogon pratensis L.—Potter Co.: in grassy fields, Coudersport, *16396*. Snyder Co.: in waste ground and fields, Selinsgrove, *2472*. Warren Co.: along roadside, North Warren, *16385*.

AMBROSIACEAE

Ambrosia elatior L.—Warren Co.: in waste ground and along roadsides, North Warren, *15538*.

Ambrosia trifida L.—Warren Co.: in waste ground, along fences, and along roadsides, North Warren, *15539*, *16752*.

CARDUACEAE[12]

Achillea asplenifolia Vent.—Bedford Co.: in outdoor cultivation, Bedford Springs, *3361*.

Achillea millefolium L.—Potter Co.: in fields, Coudersport, *16406*. Warren Co.: in grassy fields and along roadsides, North Warren, *14958*, *15269*, *17810*.

Achillea millefolium f. *rosea* Rand & Redfield—Warren Co.: in lawns, North Warren, *15318*.

Achillea ptarmica L.—Warren Co.: in outdoor cultivation and tending to spread, North Warren, *16462*, verif. Bailey, *16633*, verif. Bailey; in outdoor cultivation and escaped, Sheffield, *16529*, verif. Bailey.

Achillea ptarmica f. *multiplex* (P. DC) Moldenke—Potter Co.: in outdoor cultivation, Coudersport, *16658*, verif. Bailey. Warren Co.: in outdoor cultivation and tending to spread, North Warren, *15246*.

Actinomeris alternifolia (L.) P. DC.—Snyder Co.: in moist soil near "Swinging Bridge," Selinsgrove, *2744*, cited as "*Ridan alternifolius* (L.) Britton" on page 95 of the Annotated List and so distributed.

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12 The *Flaveria linearis* Lag. erroneously recorded from Pennsylvania on page 92 of the Annotated List, based on number *8656*, was actually collected in Florida; vid. Am. Midland Naturalist **32**:565. 1944.

Ageratum conyzoides L.—Warren Co.: in indoor cultivation, North Warren, *15069*, verif. Bailey.

Ageratum houstonianum Mill.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2392*. Warren Co.: in outdoor cultivation and becoming weedy in cultivated ground, North Warren, *15759*, verif. Bailey.

Anaphalis margaritacea var. *intercedens* Hara—Potter Co.: in dry grassy fields, Coudersport, *16565*. Warren Co.: in clearings in woodlands and in dry fields, North Warren, *15797*, *16615*; in open woods between Sheffield and Blue Jay, along the Tionesta Creek, *17584*; in grassy meadows along Four Mile Creek, *18035*; in grassy fields, Willow Street Run, Sheffield, *18111*.

Antennaria fallax Greene—Warren Co.: on roadside banks, Russell, *14536*; in clearings along wood roads, North Warren, *15799*, det. by Stebbins as "looks like *A. fallax* Greene, but I would need flowering specimens to be sure of this"; colonial in clearings in woods, near Kinzua, *17227*.

Antennaria neodioica Greene—Snyder Co.: forming large colonies in lawns, Selinsgrove, *3836*.

Antennaria parlinii Fernald—Warren Co.: on banks along wood roads, Warren, *14769*, det. Stebbins.

Antennaria plantaginifolia (L.) Richards—Snyder Co.: in moist rocky soil along Susquehanna River, Selinsgrove, *3837*.

Anthemis arvensis L.—Snyder Co.: in waste fields along old canal-bed, Selinsgrove, *2841*.

Arctium minus Bernh.—Potter Co.: in waste ground, Coudersport, *16724*. Warren Co.: in waste and cultivated ground, Warren, *15329*.

Artemisia albula Wooton—Warren Co.: in outdoor cultivation and spreading, North Warren, *16584*, verif. Bailey.

Artemisia vulgaris L.—Warren Co.: in outdoor cultivation and tending to spread, North Warren, *15826*, verif. Bailey.

Aster acuminatus Michx.—Warren Co.: in dense dark woodlands, North Warren, *15682*; in deep woods, Deerlick road, Sheffield, *17710*; in dense woods, near Brookston, *18003*; in dense woods along Four Mile Creek, *18037*.

Aster cordifolius L.—Warren Co.: in dense woodlands, North Warren, *15857*, det. Alexander.

Aster curvescens Burgess—Monroe Co.: along creek in dense woodlands, Buck Hill Falls, *3009*.

Aster divaricatus L.—Warren Co.: in woodlands, North Warren, *15796*, *16758*; in woodlands east of Russell, *16843*; in dense woods, Sheffield, *17846*; in woodlands between North Warren and Russell, *17902*; in dense woods near Brookston, *18002*; in dense woods along Four Mile Creek, *18048*; in deep woods, Willow Street Run, Sheffield, *18120*.

Aster glomeratus (Nees) Bernh.—Warren Co.: at edge of woods, North Warren, *15610*; in dense woods, near Brookston, *18001*.

Aster hirsuticaulis Lindl.—Forest Co.: in meadows, Tionesta Dam, *16800*. Warren Co.: in thickets along roadsides, and in fields, North Warren, *15836*; in grassy fields one mile southwest of Sheffield, *17019*; in meadows, near Sheffield, *18216*.

Aster lamarckianus Nees—Forest Co.: in meadows, Tionesta Dam, *16801*. Snyder Co.: in meadows and ditches along road to Penn Avon, Selinsgrove, *2760*, distributed as "*A. paniculatus* Lam." Warren Co.: in cultivated ground, grassy fields, hedgerows, moist meadows, and in marsh on island in Conewango Creek, North Warren, *15984*, *16640*, *16751*, *16822*, *18085*, *18098*; in moist meadows along Four Mile Creek, *18042*; in grassy fields, Willow Street Run, Sheffield, *18105*.

Aster lateriflorus (L.) N. L. Britton—Warren Co.: in grassy meadows, North Warren, *16832*.

Aster lowrieanus Porter—Snyder Co.: in moist soil along creek, Selinsgrove, *4183*. Warren Co.: in woodlands, North Warren, *16755*.

Aster macrophyllus L.—Potter Co.: in moist dark woods, Coudersport, *16726*, *16742*. Warren Co.: in damp open woodlands, North Warren, *15417*, *17864*; in dense woods along Four Mile Creek, *18030*; in deep woods, Willow Street Run, Sheffield, *18119*.

Aster multiformis Burgess—Cameron Co.: in woodlands, Emporium, *3988*.

Aster novae-angliae L.—Warren Co.: in meadows and in outdoor cultivation, North Warren, *15967*, *16830*; in moist meadows, Willow Street Run, Sheffield, *18117*.

Aster novae-angliae f. *lilacina* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15968* (type), verif. Bailey.

Aster novi-belgii L.—Monroe Co.: in meadows, Lutherland, Pocono Mountains, *10718*. Warren Co.: in fields and meadows, and in outdoor cultivation and escaped, North Warren, *15951*, *15953*, *15958*; in meadows about one mile southwest of Sheffield, *17021*. The three North Warren collections were det. as "*A. novi-belgii*, L., cultivar" by Bailey.

Aster patens Ait.—Northumberland Co.: on slope of Mt. Mahanoy, Herndon, *3119*.

Aster prenanthoides Muhl.—Forest Co.: in meadows, Tionesta Dam, *16803*, det. Monachino; in moist ditches, Tionesta Fish Hatchery, *16813*, verif. Monachino. Potter Co.: in moist ditches, Coudersport, *16691*. Warren Co.: in moist grassy meadows, on shale embankments, and on rocky cliffs, North Warren, *15666*, *15991*, *16821*, verif. Monachino, *17926*; in roadside ditches, near Brookston, *18004*; in moist fields and meadows, Willow Street Run, Sheffield, *18118*, *18122*, *18123*.

Aster puniceus L.—Forest Co.: in meadows, Tionesta Dam, *16804*. Monroe Co.: in meadows, Lutherland, Pocono Mountains, *10717*. Potter Co.: in wet meadows, Coudersport, *16721*. Snyder Co.: along moist roadsides, Penn Avon, *3111*. Warren Co.: in grassy fields on hillside one mile southwest of Sheffield, *17022*; in marsh along Four Mile Creek, *18053*; in moist meadows, Willow Street Run, Sheffield, *18121*; in marsh, near Sheffield, *18212*.

Aster roscidus Burgess—Bedford Co.: in woods, Bedford Springs, *3386*.

Aster sagittifolius var. *urophyllus* (Lindl.) Burgess—Snyder Co.: along banks of Middle Creek, Selinsgrove, *4179*.

Aster schreberi Nees—Potter Co.: in dark moist woods, Coudersport, *16722*.

Aster undulatus L.—Warren Co.: in dense woodlands, North Warren, *15856*, det. Alexander.

Aster sp.—Warren Co.: in meadows and along sides of railroad embankments, North Warren, *15550*.

Bellis perennis L.—Warren Co.: common weed in grassy lawns, colonial, Warren, *14534*.

Bidens cernua L.—Snyder Co.: on rocky banks of Penn's Creek, Penn Avon, *2766*. Warren Co.: in wet marshes east of Russell, *16838*; in marshy meadows, North Warren, *18086*.

Bidens comosa (A. Gray) Wiegand—Snyder Co.: in dried-up marshes, Selinsgrove, *4206*. Warren Co.: in wet marsh east of Russell, *16839*; in moist ditch one mile southwest of Sheffield, *17008*; in moist meadows, near Brookston, *18014*; in marshy ground along Four Mile Creek, *18041*; in marsh on island in Conewango Creek, North Warren, *18102*.

Bidens ferulaefolia (Jacq.) P. DC.—Warren Co.: in outdoor cultivation, North Warren, *16579*, verif. Bailey.

Bidens frondosa L.—Forest Co.: in grassy ditches, Tionesta Fish Hatchery, *16812*. Warren Co.: in grassy fields east of Russell, *16842*; in moist ditches one mile southwest of Sheffield, *17011*; in marshy meadows, North Warren, *18103*.

Bidens laevis (L.) B.S.P.—Forest Co.: in moist meadows, Tionesta Fish Hatchery, *16820*. Warren Co.: in marshes, North Warren, *16824*.

Bidens vulgata Greene—Warren Co.: in marshy ground and ditches and along margins of wood roads, North Warren, *15801*, *16746*; in dry fields along Four Mile Creek, *18047*.

Boltonia asteroides L'Hér.—Warren Co.: in outdoor cultivation, tending to spread, North Warren, *15957*, verif. Bailey.

Brachycome iberidifolia Benth.—Warren Co.: in indoor and outdoor cultivation, North Warren, *17096*.

Calendula officinalis L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14601*, verif. Bailey.

Callistephus chinensis (L.) Nees—Snyder Co.: in indoor and outdoor cultivation, Selinsgrove, *4164*. Warren Co.: in indoor and outdoor cultivation, North Warren,

15521, verif. Bailey, cited as "C. *chinensis* Nees" on page 23 of the Observed Flora of Warren.

Centaurea cineraria L.—Warren Co.: in indoor cultivation, North Warren, *14942*, det. with a question by Bailey.

Centaurea cyanus L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *15699*, verif. Bailey.

Centaurea dealbata Willd.—Bedford Co.: in outdoor cultivation, Bedford Springs, *3246*.

Centaurea montana L.—Warren Co.: in outdoor cultivation and becoming weedy in cultivated and waste ground, North Warren, *14610*, verif. Bailey.

Chrysanthemum coccineum Willd.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2823*. Warren Co.: in outdoor cultivation, North Warren, *14900*, verif. Bailey.

Chrysanthemum frutescens L.—Warren Co.: in indoor cultivation, Warren, *14456*, verif. Bailey; in indoor and summer outdoor cultivation, North Warren, *14947*, verif. Bailey.

Chrysanthemum morifolium Ram.—Warren Co.: in indoor and outdoor cultivation, North Warren, *15999*, verif. Bailey.

Chrysanthemum parthenium (L.) Pers.—Northumberland Co.: escaped from cultivation along roadsides, Fisher's Ferry, *2763*, distributed as "C. *parthenium* Bernh." and cited as "*Matricaria parthenium* L." on page 94 of the Annotated List.

Chrysanthemum parthenium f. *discoidale* Moldenke—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *16364* (type), verif. Bailey.

Cirsium altissimum (L.) Spreng.—Montgomery Co.: in grassy roadside embankments, Perkiomenville, *13876*.

Cirsium arvense (L.) Scop.—Potter Co.: in grassy fields, Coudersport, *16693*. Warren Co.: forming large colonies along roadsides and in waste places, North Warren, *15264*, *17695*.

Cirsium discolor (Muhl.) Spreng.—Potter Co.: in grassy fields, Coudersport, *16694*.

Cirsium muticum Michx.—Warren Co.: in meadows and along margins of old wood roads, North Warren, *15388*, *16698*.

Cirsium vulgare (Savi) Airy-Shaw—Warren Co.: in fields, pastures, along fencerows, and at margins of wood roads, North Warren, *15428*.

Coreopsis grandiflora Nutt.—Warren Co.: in outdoor cultivation and naturalized, North Warren, *15023*, verif. Bailey.

Coreopsis tinctoria Nutt.—Warren Co.: in indoor and outdoor cultivation and escaped in waste ground and dumps, North Warren, *15130*, verif. Bailey.

Coreopsis tinctoria var. *atropurpurea* Hook.—Warren Co.: in outdoor cultivation and sparingly escaped, North Warren, *15230*, verif. Bailey. The no. *8222* cited from Pennsylvania on page 91 of the Annotated List was actually collected in New Jersey.

Coreopsis tripteris L.—Warren Co.: in hedgerows, North Warren, *16613*.

Cosmos bipinnatus Cav.—Snyder Co.: in outdoor cultivation and escaped, Selinsgrove, *6699*. Warren Co.: in outdoor cultivation and escaped as weed along roadsides and in dumps, North Warren, *15236*.

Cosmos sulphureus Cav.—Warren Co.: in outdoor cultivation, North Warren, *15821*, verif. Bailey.

Cota tinctoria (L.) J. Gay—Warren Co.: in outdoor cultivation and tending to spread, North Warren, *15149*, distributed as "*Anthemis tinctoria* L." and so verif. by Bailey.

Dahlia pinnata Cav.—Warren Co.: in outdoor cultivation, North Warren, *15942*, verif. Bailey.

Dimorphotheca aurantiaca P. DC.—Warren Co.: in outdoor cultivation, North Warren, *16444*, verif. Bailey.

Dimorphotheca hybrida P. DC.—Warren Co.: in outdoor cultivation, North Warren, *16452*, verif. Bailey.

Doellingeria umbellata (Mill.) Nees—Forest Co.: in meadows, Tionesta Fish Hatchery, *16815*. Warren Co.: in moist meadows between Sheffield and Brookston, *18130*.

Doronicum clusii Tausch—Warren Co.: in outdoor cultivation, North Warren, *14984*, verif. Bailey.

Erechtites hieracifolia (L.) Raf.—Warren Co.: in dry soil along roadways, waste ground, and burned-over places, North Warren, *15488;* in burned-over woods one mile southwest of Sheffield, *17013;* in thickets along Four Mile Creek, *18039.*

Erigeron annuus (L.) Pers.—Warren Co.: in waste ground, fields, and along roadsides, North Warren, *14911, 16370;* in grassy fields between Irvington and Tideoute, *17493.*

Erigeron philadelphicus L.—Potter Co.: in fields, Coudersport, *16417.* Warren Co.: in waste and cultivated ground, North Warren, *14894, 15095, 17406.*

Erigeron ramosus (Walt.) B.S.P.—Potter Co.: in waste ground, Coudersport, *16727.* Warren Co.: in waste and cultivated ground and fields, North Warren, *14886, 17678.*

Eupatorium fistulosum Barratt—Potter Co.: in moist meadows, Coudersport, *16725.* Warren Co.: in meadows, wet hollows, and marshy ground along Conewango Creek, North Warren, *15259, 15546, 16470, 16471;* in grassy meadows between Sheffield and Blue Jay, *17586.*

Eupatorium perfoliatum L.—Potter Co.: in wet meadows, Coudersport, *16688.* Warren Co.: in meadows and at edge of Conewango Creek, North Warren, *15556, 16472;* in grassy thickets between North Warren and Russell, *17894.*

Eupatorium purpureum L.—Warren Co.: in moist meadows, thickets, and margins of woods, North Warren, *15567, 16500, 17671.*

Eupatorium rugosum Houtt.—Forest Co.: in woodlands, Tionesta Dam, *16807.* Snyder Co.: in outdoor cultivation, Selinsgrove, *6697,* cited as "*E. urticaefolium* Reichard" on page 92 of the Annotated List and distributed as "*E. ageratoides* L. f." Warren Co.: in dark woods, Sheffield, *17849.*

Euthamia graminifolia var. *nuttallii* (Greene) W. Stone—Potter Co.: in dry fields, Coudersport, *16717.* Warren Co.: in grassy fields, meadows, along fencerows, and on hillsides, often infested with the galls of *Asteromyia carbonifera* Felt [fide Stevenson], North Warren, *15794, 16766, 16787, 16833, 16834, 17809.*

Gaillardia aristata var. *sanguinea* Olmsted, Coville, & Kelsey—Warren Co.: in outdoor cultivation, North Warren, *15022,* verif. Bailey.

Gaillardia pulchella Foug.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4525.*

Gaillardia pulchella var. *picta* A. Gray—Bedford Co.: in outdoor cultivation, Bedford Springs, *3244.*

Gaillardia pulchella var. *picta* f. *lorenziana* (L. H. Bailey) Moldenke—Warren Co.: in outdoor cultivation, North Warren, *16456,* verif. Bailey.

Galinsoga ciliata (Raf.) Blake—Snyder Co.: in waste and cultivated ground, Selinsgrove, *2771,* distributed as "*G. parviflora* Cav." Warren Co.: in waste and cultivated ground, a pernicious weed, North Warren, *14878.*

Gazania rigens R. Br.—Warren Co.: in indoor cultivation, North Warren, *14719,* det. Bailey.

Gerbera jamesoni H. Bolus—Warren Co.: in indoor cultivation, North Warren, *15082,* verif. Bailey.

Gnaphalium decurrens Ives—Warren Co.: in grassy meadows along Four Mile Creek, *18029;* in grassy fields, Willow Street Run, Sheffield, *18108.*

Gnaphalium obtusifolium L.—Warren Co.: in dry fields on hillsides, North Warren, *15784;* in grassy fields one mile southwest of Sheffield, *17014;* in grassy meadows along Four Mile Creek, *18036;* in grassy fields, Willow Street Run, Sheffield, *18109.*

Gnaphalium purpureum L.—Warren Co.: in dry shale embankments and in marsh on island in Conewango Creek, North Warren, *15697, 18091;* in dry fields along Four Mile Creek, *18034.*

Gnaphalium uliginosum L.—Northumberland Co.: in dry soil along roadsides, Herndon, *4186,* distributed as "*G. purpureum* L."

Helenium autumnale var. *grandiflorum* Fletcher—Warren Co.: in outdoor cultivation, North Warren, *18079.*

Helenium autumnale var. *rubrum* Fletcher—Warren Co.: in outdoor cultivation, North Warren, *15960,* verif. Bailey.

Helenium latifolium Mill.—Warren Co.: in moist or marshy meadows, dried streambeds, along streams, and on the banks of Conewango Creek, North Warren, *15787, 16634, 16828, 17694, 17973, 18098a.*

Helianthus annuus L.—Warren Co.: in outdoor cultivation and escaped, North Warren, *15965*, verif. Bailey.

Helianthus annuus var. *nanus* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *17878*.

Helianthus decapetalus L.—Forest Co.: in woodlands, Tionesta Fish Hatchery, *16816*. Warren Co.: in woodlands, thickets, and along margins of wood roads, North Warren, *15489*, *15690*, *17920*, *18223*; in woods between North Warren and Russell, *17893*.

Helianthus decapetalus var. *flore-pleno* Fletcher—Snyder Co.: in outdoor cultivation, Selinsgrove, *3107*, cited as "var. *multiflorus* Hort." on page 93 of the Annotated List and so distributed.

Helianthus divaricatus L.—Monroe Co.: in woods, Buck Hill Falls, *2983*. Warren Co.: in woodlands, thickets, and along edge of wood roads, North Warren, *15450*, *16469*, *16629*, *17762*, *17867*.

Helianthus rigidus Desf.—Warren Co.: in outdoor cultivation, tending to spread, North Warren, *15962*, det. Bailey; in dense colony on grassy bank one mile southwest of Sheffield, *17018*.

Helianthus strumosus L.—Warren Co.: in cut-over woodlands on hillsides, North Warren, *15597*.

Helianthus tuberosus L.—Warren Co.: along fencerows and hedgerows, North Warren, *16479*, *16545*; along moist fencerows, Four Mile Creek, *18051*.

Helichrysum bracteatum H. C. Andr.—Warren Co.: in outdoor cultivation, North Warren, *15516*, verif. Bailey.

Heliopsis helianthoides (L.) Sweet—Warren Co.: in fields, at margins of woodlands, in woods, and in thickets along Conewango Creek, North Warren, *15846*, *16540*, *17837*.

Heliopsis scabra Dunal—Clinton Co.: in dry soil along roadsides, Lock Haven, *3354*. Warren Co.: in woodlands and in outdoor cultivation, North Warren, *15255*, verif. Bailey, *16636*.

Helipterum manglesii F. Muell.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3229*.

Helipterum roseum Benth.—Lackawanna Co.: in outdoor cultivation, Scranton, *4756*.

Kleinia articulata Haw.—Warren Co.: in indoor cultivation and growing as weed in greenhouse benches, Warren, *14477*, det. Bailey.

Kleinia repens (L.) Harv.—Warren Co.: in indoor cultivation and growing as weed in greenhouse benches, North Warren, *15830*, verif. Bailey.

Leptilon canadense (L.) N. L. Britton—Warren Co.: in dry soil along roadside and in waste ground, North Warren, *15495*, *17934*.

Leucanthemum maximum P. DC.—Warren Co.: in indoor and outdoor cultivation, North Warren, *15256*, verif. Bailey.

Leucanthemum vulgare Lam.—Warren Co.: in grassy fields, Sheffield, *17374*.

Leucanthemum vulgare var. *pinnatifidum* (Lecq. & Lamotte) Moldenke—Warren Co.: in outdoor cultivation and naturalized in fields and waste places, North Warren, *15103*, verif. Bailey; in grassy fields between Irvington and Tideoute, *17492*; in dry grassy fields between Sheffield and Blue Jay along the Tionesta Creek, *17593*.

Ligularia kaempferi Sieb. & Zucc.—Warren Co.: in indoor cultivation, North Warren, *16342*, verif. Bailey.

Ligularia kaempferi var. *aureomaculata* L. H. Bailey—Perry Co.: in indoor cultivation, Blain, *4251*, cited as "var. *aureomaculata* Hort." on page 94 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *16224*, verif. Bailey.

Maruta cotula (L.) P. DC.—Snyder Co.: in dry fields along road to Penn Avon, Selinsgrove, *3230*, distributed as "*Anthemis cotula* L." Warren Co.: in waste and cultivated ground, North Warren, *14932*.

Matricaria parthenoides Desf.—Warren Co.: in indoor cultivation, North Warren, *15009*, verif. Bailey.

Onoperdum acanthium L.—Potter Co.: in outdoor cultivation and escaped into fields, Coudersport, *16713*. Warren Co.: in indoor and outdoor cultivation, North Warren, *17471*.

Othonna crassifolia Haw.—Snyder Co.: in indoor and summer outdoor cultivation, Selinsgrove, *4178*.

Piqueria trinervia Cav.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16018*, verif. Bailey.

Rudbeckia hirta L.—Potter Co.: in dry grassy fields, Coudersport, *16560*. Warren Co.: in grassy fields about 2 miles west of Warren, *15168*; in dry grassy fields, North Warren, *15271*, *16431*, *17670*.

Rudbeckia laciniata L.—Warren Co.: on banks of the Allegheny River, Warren, *15330*; in marshy ground along Conewango Creek, North Warren, *16489*, *17683*; along side of stream, Sheffield, *17853*.

Rudbeckia laciniata var. *hortensia* L. H. Bailey—Warren Co.: in outdoor cultivation and escaped, North Warren, *15323*, verif. Bailey.

Rudbeckia triloba L.—Warren Co.: along roadsides and in fields and meadows, North Warren, *15775*.

Senecio aureus L.—Snyder Co.: in wet fields along Penn's Creek, Penn Avon, *3180*. Warren Co.: in wet meadows, near Sheffield, *16331*; in marshy ground between North Warren and Russell, *17245*.

Senecio cruentus P. DC.—Warren Co.: in indoor cultivation, North Warren, *16129*, verif. Bailey.

Senecio leucostachys J. G. Baker—Warren Co.: in indoor cultivation, Warren, *14468*, det. Bailey; in indoor cultivation, North Warren, *14943*, det. Bailey.

Senecio mikanioides Otto—Warren Co.: in indoor and summer outdoor cultivation, Warren, *14478*, det. Bailey.

Sericocarpus asteroides (L.) B.S.P.—Forest Co.: in open woods along Tionesta Creek from Henry's Mills to Kellettville, *17622*. Warren Co.: in open woodlands, North Warren, *15205*, *15795*.

Silybum marianum (L.) Gaertn.—Warren Co.: in outdoor cultivation, North Warren, *16445*, verif. Bailey.

Solidago altissima L.—Potter Co.: in dry grassy fields, Coudersport, *16696*, *16716*. Warren Co.: in dry open grassy fields, thickets, and woodlands, North Warren, *15544*, *15864*, *15976*, *16665*, *16831*; in woodlands one mile southwest of Sheffield, *17020*; in grassy meadows and thickets along Four Mile Creek, *18031*, *18045*.

Solidago bicolor L.—Potter Co.: in dark woods, Coudersport, *16729*. Warren Co.: in grassy fields, on hillsides, and in open woodlands, North Warren, *15583*, *16759*; in dense woods along Four Mile Creek, *18049*.

Solidago caesia L.—Warren Co.: in dense and in open woodlands, North Warren, *15850*, *16760*; in woodlands one mile southwest of Sheffield, *17023*; in dense woods along Four Mile Creek, *18055*.

Solidago canadensis L.—Montgomery Co.: in ditches along roadside, Norristown, *13801*. Warren Co.: in open grassy fields, North Warren, *15604*, *15863*, *16764*; in grassy fields, Willow Street Run, Sheffield, *18104*.

Solidago erecta Pursh—Snyder Co.: in rocky woods, alt. about 400 feet, Mount Shikellimy, *4196*.

Solidago hirsutissima Mill.—Warren Co.: in colonies along roadsides and in fields, North Warren, *15849*; in grassy meadows along Four Mile Creek, *18044*.

Solidago hispida Muhl.—Snyder Co.: along banks of Penn's Creek, Penn Avon, *3112*.

Solidago juncea Ait.—Potter Co.: in meadows and dark woods, Coudersport, *16719*. Warren Co.: in grassy fields, North Warren, *17771*, *17859*.

Solidago latifolia L.—Snyder Co.: on ledges along rocky banks of Penn's Creek, Penn Avon, *2746*. Warren Co.: in deep woods, near Sheffield, *18214*.

Solidago monticola T. & G.—Snyder Co.: in rocky woods, alt. about 350 feet, Mount Shikellimy, *4195*.

Solidago nemoralis Ait.—Warren Co.: in dry grassy fields and at edge of woodlands, North Warren, *15791*; in dry barren fields, Willow Street Run, Sheffield, *18113*.

Solidago patula Muhl.—Warren Co.: in marshes between Sheffield and Brookston, *18131*; in marsh near Sheffield, *18213*; in dense woods, North Warren, *17764*.

Solidago squarrosa Muhl.—Warren Co.: along margins of wood roads, North Warren, *15693*, *17681*.

Solidago ulmifolia Muhl.—Warren Co.: in woodlands, North Warren, *16756*.

Stokesia laevis Greene—Warren Co.: in outdoor cultivation, North Warren, *16581*, verif. Bailey.

Synosma suaveolens (L.) Raf.—Warren Co.: in marsh on island in Conewango Creek, and in meadows, North Warren, *16637*, *18087*.

Tagetes erecta L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4170*. Warren Co.: in outdoor cultivation, North Warren, *15700*, verif. Bailey.

Tagetes erecta f. **discoidalis** Moldenke, f. nov.—Haec forma a forma typica speciei floribus capituli toto discoidiis tubulosis recedit. This form differs from the typical form of the species and from f. *pleniflora* Moldenke in having the heads composed entirely of tubular ray-florets. The type (no. *18081*) was collected in outdoor cultivation at North Warren, Warren County, Pennsylvania, on September 14, 1945.

Tagetes patula L.—Warren Co.: in outdoor cultivation, North Warren, *14750*, verif. Bailey.

Tanacetum vulgare L.—Potter Co.: along roadsides and hedgerows, Coudersport, *16694a*, *16743*. Warren Co.: along fencerows, North Warren, *16664*; along fencerows, Four Mile Creek, *18052*.

Tithonia diversifolia (Hemsl.) A. Gray—Warren Co.: in outdoor and indoor cultivation, North Warren, *15649*, verif. Bailey.

Tussilago farfara L.—Potter Co.: along roadsides and on banks, Coudersport, *16276*. Warren Co.: along filled-in roadsides, North Warren, *16187*; on dry embankments, Tideoute, *16811*; on railroad embankments at border of Forest County between Henry's Mills and Blue Jay, *17104*.

Vernonia noveboracensis (L.) Willd.—Forest Co.: in meadows, Tionesta Dam, *16808*.

Zinnia elegans Jacq.—Snyder Co.: in outdoor cultivation, Selinsgrove, *4176*. Warren Co.: in outdoor cultivation, North Warren, *15315*, verif. Bailey.

Zinnia haageana Regel—Warren Co.: in outdoor cultivation, North Warren, *15658*, verif. Bailey, *16455*, verif. Bailey.

GENTIANACEAE

Anthopogon crinitum (Froel.) Raf.—Monroe Co.: in meadows, Lutherland, Pocono Mountains, *10716*.

Dasystephana andrewsii (Griseb.) Small—Warren Co.: in marshy meadows, near Kinzua, *15948*; in marshy meadows, North Warren, *16790*, *16827*.

Dasystephana andrewsii f. *albiflora* (N. L. Britton) Moldenke—Warren Co.: in meadows, Tideoute, *16810*; in meadows, near Brookston, *17998*.

Dasystephana saponaria (L.) Small—Warren Co.: in marshy ground along small woodland stream, North Warren, *15429*.

Gentianella quinquefolia (L.) Small—Monroe Co.: in meadows, Lutherland, Pocono Mountains, *10715*.

PRIMULACEAE

Anagallis arvensis L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16420*, verif. Bailey.

Anagallis arvensis var. *caerulea* (Schreb.) Gren. & Godr.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16421*, verif. Bailey.

Cyclamen indicum var. *giganteum* (L. H. Bailey) L. H. Bailey—Snyder Co.: in indoor cultivation, Selinsgrove, *2793*, cited as "C. *persicum* var. *giganteum* Hort." on page 98 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *16106*, verif. Bailey.

Dodecatheon meadia L.—Snyder Co.: on moist cliffs at "The Narrows," Selinsgrove, *2315*.

Lysimachia clethroides Duby—Warren Co.: in outdoor cultivation and tending to spread, North Warren, *15306*, verif. Bailey.

Lysimachia nummularia L.—Warren Co.: in wet mud along Conewango Creek, North Warren, *15540*.

Lysimachia punctata L.—Snyder Co.: in outdoor cultivation, Salem, *3864*.

Lysimachia quadrifolia L.—Warren Co.: in dense woodlands, North Warren, *15573;* in open woods along Conewango Creek between North Warren and Russell, *17575*.

Lysimachia terrestris (L.) B.S.P.—Forest Co.: in swamp along Tionesta Creek from Henry's Mills to Kelletville, *17645*. Monroe Co.: in marsh along edge of lake, Buck Hill Falls, *2982*. Warren Co.: in marshes, North Warren, *16358*.

Lysimachia vulgaris L.—Warren Co.: in outdoor cultivation and spreading as a weed, North Warren, *15125*, verif. Bailey.

Primula malacoides Franch.—Snyder Co.: in indoor cultivation, Selinsgrove, *3816*. Warren Co.: in indoor cultivation, North Warren, *16173*, verif. Bailey.

Primula obconica Hance—Warren Co.: in indoor cultivation, Warren, *14831*, det. Bailey.

Primula polyantha Mill.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2334*. Warren Co.: in outdoor cultivation, North Warren, *14581*, verif. Bailey.

Primula sinensis Sabine—Snyder Co.: in indoor cultivation, Selinsgrove, *2241*.

Primula veris L.—Warren Co.: in outdoor cultivation, North Warren, *16204*, verif. Bailey.

Steironema ciliatum (L.) Raf.—Warren Co.: in moist meadows about 2 miles west of Warren, *15163;* in moist woodland clearings, wet ditches, and along woodland streams, North Warren, *15211*, *15280*, *16425*, *16465;* in muddy thickets along Conewango Creek between North Warren and Russell, *17564*.

Trientalis borealis Raf.—Monroe Co.: in woods along roadsides, Buck Hill Falls, *2580*, distributed as "*T. americana* Pursh." Warren Co.: in deep damp woods, North Warren, *14674*, *16248*, *17676*.

PLUMBAGINACEAE

Limonium bonduelli (Lest.) Kuntze—Lackawanna Co.: in indoor cultivation, Scranton, *5064*, cited as "*L. bonduellii* Kuntze" on page 98 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, Warren, *14563*, verif. Bailey; in indoor and outdoor cultivation, North Warren, *16503*, verif. Bailey.

Limonium bonduelli var. *album* L. H. Bailey—Warren Co.: in indoor and outdoor cultivation, North Warren, *16504*, det. Bailey, *16267*, det. Bailey.

Limonium carolinianum (Walt.) N. L. Britton—Warren Co.: in outdoor cultivation, North Warren, *15823*, verif. Bailey.

Limonium pectinatum (Ait.) Kuntze—Lackawanna Co.: in indoor cultivation, Scranton, *5065*, cited as "*L. pectinatum* Kuntze" on page 98 of the Annotated List and so distributed.

Limonium sinuatum (L.) Mill.—Warren Co.: in indoor and outdoor cultivation, Warren, *14562*, verif. Bailey.

Plumbago capensis Thunb.—Warren Co.: in indoor cultivation, North Warren, *14698*, verif. Bailey.

Statice armeria L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3186*.

PLANTAGINACEAE

Plantago lanceolata L.—Potter Co.: in waste ground, Coudersport, *16401*. Snyder Co.: in lawns and waste places, Selinsgrove, *2288*. Warren Co.: in lawns and waste ground, North Warren, *14969*.

Plantago major L.—Monroe Co.: in woods along side of trail, Buck Hill Falls, *2999*. Warren Co.: in lawns and waste ground, North Warren, *15102*, *15769*.

Plantago rugelii Decaisne—Potter Co.: in grassy fields, Coudersport, *16692*. Warren Co.: in grassy lawns and waste ground, North Warren, *15222*.

CAMPANULACEAE

Campanula carpatica Jacq.—Warren Co.: in outdoor cultivation, North Warren, *16582*, det. Bailey.

Campanula isophylla Moretti—Warren Co.: in indoor cultivation, North Warren, *15415*, det. Bailey.

Campanula isophylla var. *alba* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *15406*, det. as "*C. isophylla*" by Bailey.

Campanula medium L.—Warren Co.: in outdoor cultivation, North Warren, *16343*, verif. Bailey.

Campanula medium var. *alba* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *16345*, verif. Bailey.

Campanula medium var. *calycanthema* Nichols.—Warren Co.: in outdoor cultivation, North Warren, *17469*.

Campanula medium f. **plena** Moldenke, f. nov.—Haec forma a forma typica speciei sepalibus petaloideis floribus plenis recedit. This form differs from the typical form of the species and from var. *calycanthema* Nichols. in having the calyx similar to the corolla and the corollas full-double. It is known horticulturally as the Hose-in-hose or Duplex form. The type (no. *17470*) was collected in outdoor cultivation at North Warren, Warren County, Pennsylvania, on June 21, 1945.

Campanula medium var. *rosea* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *16346*, verif. Bailey.

Campanula persicifolia L.—Warren Co.: in outdoor cultivation, North Warren, *15058*, det. Bailey, *15121*, det. Bailey, *15154*, det. Bailey, *16486*, verif. Bailey.

Campanula rapunculoides L.—Warren Co.: in dense colony in grassy field along roadside and in outdoor cultivation, North Warren, *15117*, det. Bailey, *15304*, verif. Bailey, *15599*.

Campanula rotundifolia L.—Clinton Co.: in moist fields, Lock Haven, *3353*, cited as "*C. uliginosa* Rydb." on page 99 of the Annotated List and so distributed.

Platycodon grandiflorum (Jacq.) A. DC.—Warren Co.: in outdoor cultivation, North Warren, *15241*, det. Bailey, *16485*, verif. Bailey.

Triodanis perfoliata (L.) Nieuwl.—Cumberland Co.: in dense woods, Berwick, *1992*, cited as "*Specularia perfoliata* (L.) A. DC." on page 99 of the Annotated List and so distributed.

LOBELIACEAE

Lobelia cardinalis L.—Warren Co.: at edge of Conewango Creek and in marsh on island in the creek, North Warren, *16631*, *18092*; in marshes between North Warren and Russell, *17880*.

Lobelia erinus L.—Warren Co.: in outdoor cultivation, Warren, *14835*, verif. Bailey.

Lobelia erinus var. *gracilis* L. H. Bailey—Snyder Co. in indoor cultivation, Selinsgrove, *2370*, cited as "var. *gracilis* Hort." on page 99 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *16458*, verif. Bailey.

Lobelia inflata L.—Potter Co.: in grassy fields, Coudersport, *16563*. Warren Co.: in damp shaded places, waste ground, and along old wood roads, North Warren, *15377*, verif. McVaugh, *15714*, verif. McVaugh, *16492*.

Lobelia siphilitica L.—Warren Co.: in fields on hillside and along margins of Conewango Creek, North Warren, *16632*, *16786*.

POLEMONIACEAE

Phlox divaricata var. *canadensis* (Sweet) Wherry—Snyder Co.: in woods, Shamokin Dam, *2347*, distributed as "*P. divaricata* L." Warren Co.: in moist woods, Warren, *14506*, verif. Wherry; in dense woods between North Warren and Russell, *17243*.

Phlox divaricata var. *laphami* Wood—Warren Co.: in outdoor cultivation, North Warren, *16203*, det. Wherry, who says "this is the native of the Mississippi Valley which is commoner in cultivation than the more eastern variety."

Phlox drummondii Hook.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2851*. Warren Co.: in outdoor cultivation and escaped in waste places, North Warren, *14955*, verif. Bailey.

Phlox drummondii var. *stellaris* Voss—Snyder Co.: in outdoor cultivation, Selinsgrove, *3560*.

Phlox maculata L.—Clearfield Co.: in woods, Du Bois, *4284*. Warren Co.: in hedgerows about 2 miles west of Warren, *15174*, det. as "var. *odorata* (Sweet)

Wherry" by Wherry; in grassy fields between Irvington and Tideoute, *17505;* in moist meadows by thickets, Sheffield, *17854a*, det. as "var. *odorata*" by Wherry.

Phlox paniculata L.—Warren Co.: in outdoor cultivation and naturalized in grassy fields, often showing insect and mite injuries on the leaves, North Warren, *15247*, verif. Wherry and Bailey, *16468, 16702, 17844.*

Phlox paniculata var. *alba* G. Don—Warren Co.: in grassy fields and in outdoor cultivation, North Warren, *15380*, verif. Wherry, who says "forma *alba* would be preferable," *16703.*

Phlox stolonifera Sims—Clearfield Co.: along streams, Du Bois, *4285.*

Phlox subulata L.—Clearfield Co.: in rocky ground, Grass Flats, *14488*, verif. Wherry, who says "not separable as a variety as it apparently represents a cultivated form; should not be added to the native flora of the county without investigation. I still think it is from a garden." Warren Co.: in outdoor cultivation, North Warren, *16208*, det. Wherry, who says "hort. form, minutely glandular hairy."

Phlox subulata var. *ciliata* (Brand) Wherry—Warren Co.: in outdoor cultivation, North Warren, *16215*, det. Wherry, who says "this is essentially the original variety."

Polemonium reptans L.—Snyder Co.: in wet meadows, Selinsgrove, *2309.* Warren Co.: in moist woods, Warren, *14518*, verif. Wherry; in outdoor cultivation, North Warren, *14742*, verif. Bailey and Wherry; along stream in meadows, near Kinzua, *17218.*

HYDROPHYLLACEAE

Hydrophyllum virginianum L.—Snyder Co.: in moist woods along path by old canal-bed on Isle of Que, Selinsgrove, *2842.* Warren Co.: in moist woods, Deerlick, near Sheffield, *16315.*

Phacelia dubia (L.) Small—Snyder Co.: at edge of thicket by old canal-bed on Isle of Que, Selinsgrove, *2419.*

Phacelia viscida Torr.—Warren Co.: in outdoor cultivation, Sheffield, *16325*, verif. Bailey.

BORAGINACEAE

Anchusa azurea Mill.—Warren Co.: in outdoor cultivation and escaped along roadways, North Warren, *14858*, verif. Bailey, *15042.*

Cynoglossum amabile Stapf & Drummond—Warren Co.: in outdoor cultivation and escaped in waste places, North Warren, *14753*, det. Bailey.

Cynoglossum officinale L.—Mifflin Co.: in waste rocky fields and pastures, Milroy, *2488.*

Cynoglossum virginianum L.—Perry Co.: in dry fields, Blain, *2813.*

Echium vulgare L.—Warren Co.: in dry grassy fields between Irvington and Tideoute, *17524;* in grassy railroad embankments, North Warren, *17758.*

Hackelia virginiana (L.) I. M. Johnst.—Potter Co.: at edge of woods, Coudersport, *16564.* Warren Co.: along roadsides, especially in woods, North Warren, *15566.*

Lithospermum arvense L.—Snyder Co.: along dry roadsides and in waste ground, Selinsgrove, *2389.*

Mertensia virginica (L.) Link—Snyder Co.: in moist ground at edge of Penn's Creek on Isle of Que, Selinsgrove, *2304*, cited as "*M. virginica* (L.) DC." on page 101 of the Annotated List and so distributed. Warren Co.: in marshy woods, Warren, *14511;* in moist meadows, North Warren, *14692;* in moist woodland swale, Cranbrook Farm, North Warren, *17324.*

Myosotis arvensis (L.) Hill—Warren Co.: in outdoor cultivation and naturalized in waste and cultivated ground, North Warren, *16453*, verif. Bailey.

Myosotis azorica H. C. Wats.—Warren Co.: in indoor cultivation, Warren, *14472*, verif. Bailey, *17439*, det. Bailey; in indoor cultivation, North Warren, *16183*, verif. Bailey.

Myosotis scorpioides L.—Forest Co.: in marshes along Tionesta Creek from Henry's Mills to Kelletville, *17634.* Warren Co.: in wet mud along margins of brooks, North Warren, *15212, 15277;* in small brook, Deerlick, near Sheffield, *16314;* in moist mud along Conewango Creek between North Warren and Russell, *17562.*

Myosotis sylvatica Hoffm.—Warren Co.: in outdoor cultivation, North Warren, *16206*, verif. Bailey.

Myosotis virginica (L.) B.S.P.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2343*.

HELIOTROPIACEAE

Heliotropium arborescens L.—Warren Co.: in indoor cultivation, North Warren, *14965*, distributed as "*H. peruvianum* L." and so verified by Bailey.

Heliotropium corymbosum Ruíz & Pav.—Warren Co.: in indoor cultivation, North Warren, *16147*, verif. Bailey.

SOLANACEAE

Browallia viscosa H.B.K.—Warren Co.: in indoor and outdoor cultivation and escaped as weed in gardens, North Warren, *14712*, verif. Bailey.

Browallia viscosa f. *alba* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *15314*, verif. Bailey.

Brugmansia suaveolens (Humb. & Bonpl.) Bercht. & Presl—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14952*, verif. Bailey.

Capsicum frutescens var. *conoides* L. H. Bailey—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15660*, verif Bailey, *16149*, verif. Bailey, *17092*.

Capsicum frutescens var. *grossum* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *15630*, verif. Bailey.

Datura metel L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3561*, cited as "*D. fastuosa* L." on page 102 of the Annotated List and so distributed.

Datura meteloides Dunal—Snyder Co.: in outdoor cultivation, Selinsgrove, *3553*. Warren Co.: in indoor and outdoor cultivation, becoming weedy, North Warren, *15303*, verif. Bailey.

Datura stramonium L.—Snyder Co.: in fields and waste ground, Selinsgrove, *2772*.

Lycium halimifolium Mill.—Snyder Co.: in outdoor cultivation and escaped along fences on Isle of Que, Selinsgrove, *2385*. Warren Co.: in outdoor cultivation and escaped, North Warren, *16525*, verif. Bailey.

Lycopersicum esculentum var. *cerasiforme* Alef.—Warren Co.: in outdoor cultivation and escaped, North Warren, *16523*, verif. Bailey.

Lycopersicum esculentum var. *commune* L. H. Bailey—Warren Co.: in indoor and outdoor cultivation and escaped on dumps, North Warren, *15014*, verif. Bailey.

Nicotiana alata Link & Otto—Warren Co.: in outdoor cultivation, North Warren, *15639*, det. Goodspeed.

Nicotiana alata var. *grandiflora* Comes—Snyder Co.: in outdoor cultivation, Selinsgrove, *2777*.

Nicotiana sanderae Sander—Warren Co.: in outdoor cultivation and escaped, North Warren, *15867*, verif. Goodspeed.

Nicotiana tabacum L.—Lancaster Co.: in outdoor cultivation, Mount Joy, *2758*. Warren Co.: in outdoor cultivation, North Warren, *17905*.

Nierembergia caerulea Gill.—Warren Co.: in indoor cultivation, Warren, *14463*, det. Bailey.

Petunia hybrida Vilm.—Snyder Co.: in outdoor cultivation and escaped on dumps, Selinsgrove, *2448*. Warren Co.: in outdoor cultivation and extensively escaped as a weed, North Warren, *15013*, verif. Bailey.

Petunia hybrida var. *fimbriata* L. H. Bailey—Warren Co.: in indoor and outdoor cultivation, North Warren, *15243*, verif. Bailey.

Petunia hybrida var. *nana* L. H. Bailey—Warren Co.: in indoor and outdoor cultivation, North Warren, *14837*, verif. Bailey.

Petunia violacea Lindl.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2371*.

Physalis alkekengi L.—Warren Co.: in outdoor cultivation and escaped, North Warren, *15252*, verif. Bailey.

Physalis heterophylla Nees—Warren Co.: in hedgerows between Sheffield and Blue Jay, along the Tionesta Creek, *17595*.

Physalis pubescens L.—Warren Co.: in outdoor cultivation, North Warren, *18161*.

Physalis virginiana Mill.—Snyder Co.: in dry soil along roadsides, Selinsgrove, *4184*.

Salpichroa rhomboidea Miers—Warren Co.: in indoor cultivation, Warren, *14469*, det. Bailey.

Salpiglossis sinuata Ruíz & Pav.—Warren Co.: in indoor cultivation, Warren, *14557*, verif. Bailey.

Schizanthus pinnatus Ruíz & Pav.—Warren Co.: in indoor cultivation, Warren, *14551*, verif. Bailey.

Solanum capsicastrum Link—Snyder Co.: in indoor cultivation, Selinsgrove, *3101*. Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14941*, verif. Bailey, *16150*, verif. Bailey, *17093*.

Solanum carolinense L.—Warren Co.: in dry grassy fields, along roadsides, and by fences, North Warren, *15565*, *16376*, *16767*, *17772*.

Solanum dulcamara L.—Forest Co.: on banks of Tionesta Creek from Henry's Mills to Kelletville, *17631*. Warren Co.: along edge of canal and in outdoor cultivation, North Warren, *15291*; climbing along fences, Deerlick, near Sheffield, *16322*.

Solanum jasminoides Paxt.—Warren Co.: in indoor cultivation, Warren, *14459*, verif. Bailey.

Solanum nigrum var. *guineense* L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *17447*, *17661*.

Solanum pseudo-capsicum L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15768*, verif. Bailey, *17094*.

Solanum tuberosum L.—Warren Co.: in outdoor cultivation and escaped on dumps, North Warren, *15305*, verif. Bailey.

CONVOLVULACEAE

Calonyction aculeatum (L.) House—Snyder Co.: in indoor cultivation, Shamokin Dam, *2769*.

Convolvulus americanus (Sims) Greene—Warren Co.: climbing over weeds and bushes along roadsides, fencerows, and cultivated ground, North Warren, *15134*, *15199*, *16430*, *17691*.

Ipomoea pandurata (L.) G. F. W. Mey.— Northumberland Co.: along roadsides and on fences, Fisher's Ferry, *2762*.

Ipomoea tricolor Cav.—Warren Co.: in outdoor cultivation and escaped in waste ground, North Warren, *15757*, verif. Bailey.

Pharbitis nil (L.) Choisy—Warren Co.: in outdoor cultivation and escaped, North Warren, *15641*, verif. Bailey.

Pharbitis purpurea (L.) Voigt—Warren Co.: in outdoor cultivation, North Warren, *15404*, verif. Bailey.

Strophocaulos arvensis (L.) Small—Warren Co.: along roadsides and in waste and cultivated ground, North Warren, *15108*.

CUSCUTACEAE

Cuscuta gronovii Willd.—Warren Co.: climbing on *Solidago* and *Boehmeria* in marsh, North Warren, *16776*.

SCROPHULARIACEAE

Antirrhinum majus L.—Warren Co.: in indoor and outdoor cultivation and escaped on compost piles, North Warren, *14602*, verif. Bailey, *15094*, verif. Bailey and Pennell, *18227*.

Aureolaria flava (L.) Farwell—Warren Co.: large colonies in open and in dense woodlands, North Warren, *15788*, verif. Pennell, *16625*, *17876*.

Aureolaria virginica (L.) Pennell—Warren Co.: in open woods and in dense damp woodlands, North Warren, *15449*, verif. Pennell, *16493*, *17863*.

Calceolaria herbeohybrida Voss—Warren Co.: in indoor cultivation, flowers sometimes teratologically deformed, North Warren, *17207*.

Chamaerrhinum minus (L.) Lange—Snyder Co.: in cinders along railroad tracks on Isle of Que, Selinsgrove, *3219*. Warren Co.: in roadways, North Warren, *14995*, verif. Pennell.

Chelone glabra L.—Warren Co.: along small brook in meadows, North Warren, *16666*.

Chelone glabra var. *elatior* Raf.—Warren Co.: in marshy ground and along streams in dense woodlands, North Warren, *15684*, *15819*, *17924*; in marshy ground, near Brookston, *18007*. The first two of the above collections were det. as "*C. glabra elatior* Raf." by Pennell.

Cymbalaria muralis G.M.S.—Chester Co.: in crevices between stones of old stone bridge, Brandywine Creek, Lenape, *13874*. Snyder Co.: in indoor cultivation, Penn Avon, *2748*; in indoor cultivation, Selinsgrove, *6701*. Warren Co.: in indoor cultivation and becoming a weed in and under greenhouse benches, North Warren, *14724*, verif. Bailey.

Digitalis purpurea L.—Warren Co.: in outdoor cultivation and abundantly escaped as a weed in cultivated ground, North Warren, *14993*, verif. Bailey.

Digitalis purpurea var. *alba* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *16341*, verif. Bailey.

Gratiola neglecta Torr.—Warren Co.: along margins of small streams in dense woodlands, North Warren, *15435*, verif. Pennell; in moist ditches one mile southwest of Sheffield, *17016*.

Gratiola virginiana L.—Snyder Co.: in field at edge of small pond, Selinsgrove, *3225*.

Linaria maroccana Hook. f.—Warren Co.: in indoor and outdoor cultivation, and escaped, North Warren, *14603*, verif. Bailey, *15964*, verif. Bailey; in outdoor cultivation, Sheffield, *16531*, verif. Bailey.

Linaria vulgaris Hill—Potter Co.: in dry grassy fields, Coudersport, *16554*. Warren Co.: in waste fields, on railroad embankments, and along roadsides, North Warren, *15358*, verif. Pennell, *17812*.

Melampyrum lineare Lam.—Monroe Co.: in woods along trails, Buck Hill Falls, *2980*.

Melampyrum lineare var. *latifolium* (Muhl.) Beauverd—Clinton Co.: in dense woods northwest of Hammersley, *17550*. Forest Co.: in open woods along Tionesta Creek from Henry's Mills to Kellettville, *17623*. Warren Co.: in dense woods, North Warren, *15446*, verif. Pennell, *17774*.

Mimulus alatus Soland.—Warren Co.: along side of stream, between Sheffield and Blue Jay, along the Tionesta Creek, *17585*.

Mimulus ringens L.—Forest Co.: on banks of stream along the Tionesta Creek from Henry's Mills to Kellettville, *17628*. Warren Co.: in marshes and in wet soil along small brooks, North Warren, *15276*, verif. Pennell, *16490*, *17930*; along streams, Deerlick road, Sheffield, *17715*.

Mimulus ringens f. *albiflorus* Moldenke—Warren Co.: in marshes and along brooksides, growing with the typical form, North Warren, *16491* (type), *17931*.

Pedicularis canadensis L.—Warren Co.: in woodland clearings, North Warren, *15847*, verif. Pennell; in woods, Cranbrook Farm, North Warren, *17330*.

Penstemon barbatus (Cav.) Roth—Warren Co.: in outdoor cultivation, North Warren, *14938*, verif. Bailey.

Penstemon hirsutus (L.) Willd.—Forest Co.: in meadows along Tionesta Creek from Henry's Mills to Kellettville, *17626*. Perry Co.: in dry soil on cliffs along roadside, Liverpool, *2870*. Warren Co.: in fields about 2 miles west of Warren, *15173*, verif. Pennell; in grassy fields between Irvington and Tideoute, *17508*, det. Pennell.

Scrophularia lanceolata Pursh—Snyder Co.: in fields and along roadsides, Penn Avon, *3205*, det. Pennell, distributed as "*S. leporella* Bicknell." Warren Co.: in margins of woods between Irvington and Tideoute, *17489*.

Scrophularia marilandica L.—Warren Co.: in hedgerows and thickets along Conewango Creek, North Warren, *16646*, *16783*, *17688*.

Verbascum blattaria L.—Warren Co.: in grassy fields and on dry roadside banks, North Warren, *15354*, *16769*.

Verbascum blattaria f. *albiflorum* (G. Don) House—Warren Co.: in dry grassy fields east of Russell, *16837*.

Verbascum thapsus L.—Potter Co.: in dry fields, Coudersport, *16687*. Warren Co.: on dry roadside banks, North Warren, *15364*, verif. Pennell.

Veronica americana (Raf.) Schwein.—Centre Co.: in brooks at Bear Meadows, Tusseyville, *2483*, cited as "*V. americanum* Schwein." on page 106 of the Annotated List and so distributed. Warren Co.: in brooks, North Warren, *16251*; in water of small brook between North Warren and Russell, *17246*, verif. Pennell; in brooks, Washington Park, Warren, *17436*, verif. Pennell; in small brook between Irvington and Tideoute, *17480*, verif. Pennell.

Veronica arvensis L.—Snyder Co.: in waste ground and fields, Selinsgrove, *2394*. Warren Co.: at edge of lawns and in waste and cultivated ground, North Warren, *14689*, verif Pennell, *17343*, det. Pennell, *17402*, verif. Pennell.

Veronica chamaedrys L.—Warren Co.: forming solid mats in lawns and waste ground, North Warren, *17342*, det Pennell.

Veronica didyma Tenore—Warren Co.: in waste and cultivated ground and lawns, North Warren, *14690*, det. Pennell, *16258*.

Veronica longifolia L.—Warren Co.: in outdoor cultivation, North Warren, *17992*.

Veronica longifolia var. *subsessilis* Miq.—Warren Co.: in outdoor cultivation, North Warren, *14980*, verif. Bailey.

Veronica officinalis L.—Potter Co.: in fields, Coudersport, *16415*. Snyder Co.: in lawns and thickets, Selinsgrove, *2365*. Warren Co.: in lawns and open woodland banks, North Warren, *15646*, verif. Pennell; in woods, Deerlick, near Sheffield, *16313*; in woodlands near Sheffield, *17416*, verif. Pennell.

Veronica peregrina L.—Snyder Co.: in dry sandy soil along roadsides, Selinsgrove, *2237*. Warren Co.: in waste and cultivated ground, North Warren, *14665*, verif. Pennell.

Veronica persica Poir.—Warren Co.: forming almost pure-stand mats in lawns and in waste ground, North Warren, *17190*, *17191*; in lawns, Sheffield, *17359*, det. Pennell.

Veronica serpyllifolia L.—Warren Co.: in water of brook in woods near Kinzua, *17240*, verif. Pennell; in water of streams and in marshes, Deerlick road, near Sheffield, *17264*, *17285*, verif. Pennell; in fields, Cranbrook Farm, North Warren, *17292*, verif. Pennell.

Veronica serpyllifolia f. *albiflora* Moldenke—Warren Co.: in fields, Cranbrook Farm, North Warren, *17293* (type), species verified by Pennell.

Veronicastrum virginicum (L.) Farwell—Warren Co.: in grassy meadows, along brooks, and in outdoor cultivation, North Warren, *15629*, verif. Pennell, *16384*, *17802*.

OROBANCHACEAE

Conopholis americana (L.) Wallr.—Forest Co.: in dense woods along Tionesta Creek from Henry's Mills to Kellettville, *17652*. Warren Co.: in old stump in woods, Sheffield, *17381*.

Epifagus virginiana (L.) Bart.—Bedford Co.: in woodlands, Bedford Springs, *3540*, cited as "*Leptamnium virginianum* (L.) Raf." on page 106 of the Annotated List and so distributed. Warren Co.: under *Fagus grandifolia* trees in dense woodlands, North Warren, *15675*; under beech in woods one mile southwest of Sheffield, *17010*; in beech woods near Brookston, *18021*.

Thalesia uniflora (L.) N. L. Britton—Warren Co.: in grassy meadows, Sheffield. *17380*.

GESNERIACEAE

Saintpaulia ionantha Wendl.—Warren Co.: in indoor cultivation, North Warren, *16110*, verif. Bailey.

Sinningia speciosa (Lodd.) Benth. & Hook. f.—Snyder Co.: in indoor cultivation, Selinsgrove, *3196*, cited as "*S. speciosa* Benth. & Hook. f." on page 107 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *16339* verif. Bailey.

BIGNONIACEAE

Campsis radicans (L.) Seem.—Warren Co.: in outdoor cultivation on walls, tending to escape, North Warren, *14661*, verif. Bailey.

Catalpa bignonioides Walt.—Potter Co.: in outdoor cultivation, Coudersport, *16553*, verif. Bailey. Snyder Co.: along edge of Penn's Creek, Selinsgrove, *3199*. Warren Co.: in outdoor cultivation, North Warren, *15188*, verif. Bailey.

Catalpa bignonioides var. *nana* Bur.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2768*.

ACANTHACEAE

Beloperone guttata T. S. Brandeg.—Warren Co.: in indoor cultivation, North Warren, *15087*, verif. Bailey.

Dianthera americana L.—Warren Co.: in shallow water of marshes, North Warren, *16745*.

Jacobinia velutina Voss—Warren Co.: in indoor cultivation, North Warren, *15254*, verif. Bailey.

Ruellia devosiana E. Morren—Warren Co.: in indoor cultivation, Warren, *14457*, det. Bailey.

Ruellia makoyana Barc. & Hubb.—Warren Co.: in indoor cultivation, Warren, *14458*, det. as "*Ruellia* sp. perhaps *R. makoyana*" by Bailey; in indoor cultivation, North Warren, *14960*, det. Bailey.

Thunbergia alata Bojer—Warren Co.: in indoor and outdoor cultivation, North Warren, *15085*, verif. Bailey.

VERBENACEAE

Aloysia triphylla (L'Hér.) N. L. Britton—Lackawanna Co.: in indoor cultivation, Scranton, *4235*, distributed as "*Lippia citriodora* H.B.K."

Callicarpa dichotoma (Lour.) K. Koch—Philadelphia Co.: in outdoor cultivation, Chestnut Hill, Philadelphia, *7378*.

Lantana camara L.—Clinton Co.: in indoor cultivation, Lock Haven, *3543*.

Lantana camara var. *mutabilis* (Hook.) L. H. Bailey—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14928*, verif. Bailey, *15947*, verif. Bailey, *16684*, verif. Bailey.

Lantana camara var. *nivea* (Vent.) L. H. Bailey—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14929*, verif. Bailey.

Lantana camara var. *varia* (Kuntze) Moldenke—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *16685*, verif. Bailey.

Lantana montevidensis (Spreng.) Briq.—Snyder Co.: in indoor and summer outdoor cultivation, Selinsgrove, *2420*, distributed as "*L. sellowiana* Link & Otto." Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14708*, verif. Bailey.

Verbena hastata L.—Bradford Co.: along roadsides near Grover, *17080*. Warren Co.: in moist meadows, along roadsides, and on banks of Conewango Creek, North Warren, *15275*, *15331*, *16426*, *16605*, *16650*, *17696*.

Verbena hybrida Voss—Warren Co.: in outdoor cultivation, North Warren, *14979*, verif. Bailey.

Verbena tenuisecta Briq.—Warren Co.: in indoor cultivation, Warren, *14570*, verif. Bailey; in indoor cultivation, North Warren, *17095*.

Verbena urticifolia L.—Warren Co.: in grassy fields, moist meadows, fencerows, and along roadsides, North Warren, *15332*, *16643*, *17983*.

Verbena urticifolia var. *leiocarpa* Perry & Fernald—Warren Co.: along margins of wood roads, North Warren, *15426*.

Vitex negundo L.—Warren Co.: in outdoor cultivation, North Warren, *16590*, verif. Bailey.

LAMIACEAE

Ajuga reptans L.—Warren Co.: forming dense carpet in woods between Irvington and Tideoute, *17490*.

Blephilia hirsuta (Pursh) Benth.—Warren Co.: in moist meadows along Four Mile Creek, *18054*.

Clinopodium vulgare L.—Warren Co.: in dry grassy fields, North Warren, *15262*, verif. Epling, *16386*, *16427*, *16624*, *16762*.

Coleus blumei Benth.—Snyder Co.: in indoor cultivation, Selinsgrove, *2489*.

Coleus blumei var. *verschaffeltii* Lem.—Snyder Co.: in indoor cultivation, Selinsgrove, *2490*. Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14948*, verif. Bailey, *14949*, verif. Bailey, *15662*, verif. Epling.

Coleus pumilus Blanco—Warren Co.: in indoor cultivation, Warren, *14829*, det. Bailey.

Collinsonia canadensis L.—Warren Co.: in dense woodlands, North Warren, *15483*, verif. Epling; in woodlands one mile southwest of Sheffield, *17024*.

Galeopsis tetrahit L.—Potter Co.: in fencerows, Coudersport, *16562*. Warren Co.: in hedgerows and along margins of wood roads, North Warren, *15368*, verif. Epling, *16496*, *17858*.

Glecoma hederacea var. *parviflora* (Benth.) House—Potter Co.: in lawns, moist ground, and waste places, Coudersport, *16410*, *17529*. Warren Co.: in shaded ground, Warren, *14521*, verif. Epling; in waste and cultivated ground, North Warren, *14850*, verif. Epling, *15028*, verif. Epling, *16218*.

Hedeoma pulegioides (L.) Pers.—Warren Co.: in damp shaded soil along roadsides, North Warren, *15855*, verif. Epling.

Lamium amplexicaule L.—Snyder Co.: in waste ground and along roadsides, Selinsgrove, *2303*. Warren Co.: extremely abundant weed in greenhouse benches, flats, and cultivated ground, Warren, *14471*, verif. Epling; in waste ground, Deerlick road, near Sheffield, *17269*.

Lamium maculatum L.—Warren Co.: in outdoor cultivation, tending to become weedy, Warren, *14822*, verif. Epling.

Lamium purpureum L.—Warren Co.: very common in waste and cultivated ground, mulch piles, and greenhouse benches and flats, *14555*, verif. Epling; in waste ground, Deerlick road, near Sheffield, *17270*.

Lavandula dentata L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *14946*, verif. Bailey.

Lavandula officinalis Chaix—Warren Co.: in indoor cultivation, North Warren, *15084*, verif. Bailey.

Leonurus cardiaca L.—Warren Co.: along fencerows, in thickets, and in waste and cultivated ground, North Warren, *15110*, verif. Epling, *15214*, verif. Epling, *16544*, *16740*; in waste ground and along fencerows, Bull Hill, Sheffield, *17723*.

Lycopus americanus Muhl.—Forest Co.: in wet woods along Tionesta Creek from Henry's Mills to Kelletville, *17647*. Warren Co.: in moist meadows, marshes, and along margins of small streams, North Warren, *15582*, verif. Epling, *16638*.

Lycopus rubellus Moench—Snyder Co.: along the shores of the Susquehanna River, Selinsgrove, *3106*.

Lycopus uniflorus Michx.—Forest Co.: in wet woods along Tionesta Creek from Henry's Mills to Kellettville, *17649*. Warren Co.: in moist woods and in boggy soil along small woodland streams, North Warren, *15442*, det. Epling, *15702*, det. Epling, *16601*, *16707*, *16829*.

Majorana hortensis Moench—Warren Co.: in indoor cultivation, North Warren, *14922*, det. Epling.

Mappia origanoides (L.) House—Northumberland Co.: on slope of Mt. Mahanoy, alt. about 1500 feet, Herndon, *2773*, cited as "*Cunila origanoides* L." on page 109 of the Annotated List and so distributed.

Mentha alopecuroides Hull—Monroe Co.: along roadsides, Tannersville, *8683*.

Mentha arvensis var. *canadensis* (L.) Briq.—Cameron Co.: in thickets, Emporium, *3926*, distributed as "*M. canadensis* L." Warren Co.: in marshy ground near Conewango Creek, North Warren, *17835*.

Mentha gentilis L.—Clinton Co.: in waste ground along roadsides, Lock Haven, *3562*. Warren Co.: in thickets along Conewango Creek, North Warren, *18101*.

Mentha piperita L.—Warren Co.: in marshes and along small streams, North Warren, *16598*, *16826*.

Mentha rotundifolia (L.) Huds.—Snyder Co.: along roadsides on banks of Susquehanna River, Isle of Que, Selinsgrove, *3095*.

Mentha spicata L.—Warren Co.: in moist meadows, along streams, in fencerows, and in indoor and outdoor cultivation, North Warren, *15228*, verif. Epling, *16606*, *16763*, *17935*.

Monarda clinopodia L.—Forest Co.: in thickets along Tionesta Creek from Henry's Mills to Kellettville, *17618*. Warren Co.: in woodlands and along margins of thickets, North Warren, *15342*, verif. Epling, *16482*.

Monarda didyma L.—Forest Co.: in thickets along Tionesta Creek from Henry's Mills to Kellettville, *17617*. Warren Co.: naturalized in thickets, margins of woods, and along roadsides, North Warren, *15349*, verif. Epling, *16494*, *16676*; in moist fields, Sheffield, *17848*.

Monarda fistulosa L.—Warren Co.: along railroad right-of-way, North Warren, *17807*.

Nepeta cataria L.—Potter Co.: in grassy fields, Coudersport, *16689*. Snyder Co.: in moist soil along roadsides and in waste places, Selinsgrove, *2593*. Warren Co.: in waste ground, North Warren, *15774*, verif. Epling; in waste ground, Bull Hill, Sheffield, *17722*.

Ocimum basilicum L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3554*. Warren Co.: in outdoor cultivation, North Warren, *17060*.

Origanum vulgare L.—Chester Co.: in dry fields, along fencerows, and roadsides, West Chester, *2159*.

Physostegia denticulata (Ait.) N. L. Britton—Snyder Co.: on banks of Susquehanna River, Isle of Que, Selinsgrove, *3097*.

Physostegia virginiana (L.) Benth—Warren Co.: in outdoor cultivation and tending to escape, North Warren, *15515*, verif. Bailey and Epling, *16663*, verif. Bailey.

Prunella vulgaris L.—Warren Co.: prostrate in waste and cultivated ground and lawns, North Warren, *14933*, verif. Epling; in grassy lawns, Tideoute, *16809*.

Prunella vulgaris f. *alba* Moldenke—Warren Co.: prostrate in lawns, growing along with the typical form, North Warren, *15411* (type), verif. Epling.

Prunella vulgaris var. *lanceolata* (Bart.) Fernald—Potter Co.: in grassy fields, Coudersport, *16570*. Warren Co.: along fencerows and old wood roads, North Warren, *15272*, verif. Epling; in woodlands, Sheffield, *16532*; at edge of woods, Bull Hill, Sheffield, *17719*.

Salvia azurea Michx.—Warren Co.: in outdoor cultivation, North Warren, *15970*, det. as "*S. azurea* Michx., probably subsp. *typica* Epling" by Epling and as "probably *S. pitcheri*, Torr." by Bailey.

Salvia azurea var. *grandiflora* Benth.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2756*.

Salvia farinacea Benth.—Warren Co.: in outdoor cultivation, North Warren, *16609*, det. Bailey.

Salvia horminium L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *11394*.

Salvia officinalis L.—Warren Co.: in outdoor cultivation, North Warren, *15764*, verif. Epling.

Salvia pitcheri Torr.—Warren Co.: in outdoor cultivation, North Warren, *16796*, det. Bailey.

Salvia splendens Ker—Warren Co.: in outdoor cultivation, North Warren, *15407*, verif. Bailey.

Scutellaria lateriflora L.—Warren Co.: in dense colonies in grassy meadows and along small woodland streams, North Warren, *15431*, verif. Epling, *16677*, *17979*.

Stachys arenicola N. L. Britton—Clearfield Co.: in dry fields, Du Bois, *4114*.

Stachys germanica L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2739*.

Stachys palustris var. *homotricha* Fernald—Warren Co.: in moist meadows and in marshy ground along Conewango Creek, North Warren, *15568*, verif. Epling, *16642*, *17673*, *17842*; at edge of marsh between North Warren and Russell, *17899*.

Teucrium canadense var. *virginicum* (L.) Eaton—Warren Co.: along side of stream, Warren, *15324*, verif. Epling; in moist meadows, marshy soil, ditches, waste ground, along banks of the Conewango Creek, and in outdoor cultivation, North Warren, *15547*, verif. Epling, *16542*, *16619*, *16651*.

Thymus serpyllum L.—Warren Co.: in outdoor cultivation, North Warren, *17468*, det. Bailey.

ELODEACEAE

Anacharis canadensis (Michx.) Planch.—Snyder Co.: in water of Penn's Creek, Penn Avon, *2767*, cited as "*Elodea canadensis* Michx." on page 14 of the Annotated List and so distributed.

Anacharis occidentalis (Pursh) Vict.—Forest Co.: in water of pond, Tionesta Fish Hatchery, *16814*.

VALLISNERIACEAE

Vallisneria americana Michx.—Snyder Co.: in Penn's Creek at the "Swinging Bridge," Selinsgrove, *4201*, distributed as "*V. spiralis* L." Warren Co.: floating in Conewango Creek, North Warren, *15600*.

ALISMACEAE

Alisma subcordatum Raf.—Warren Co.: in marshes, North Warren, *16701*; in marshes between North Warren and Russell, *17879*.

Helianthium parvulum (Engelm.) Small—Snyder Co.: in stagnant pool, Selinsgrove, *3832*.

Sagittaria latifolia Willd.—Warren Co.: in shallow water of marshes and in mud at edge of Conewango Creek, North Warren, *15560*, *16748*; in mud of streambanks between North Warren and Russell, *17892*.

POTAMOGETONACEAE

Potamogeton alpinus Balbis—Snyder Co.: in Penn's Creek at the "Swinging Bridge," Selinsgrove, *4207*.

Potamogeton americanus Cham. & Schlecht.— Snyder Co.: in Penn's Creek at the "Swinging Bridge," Selinsgrove, *4208*.

Potamogeton foliosus Raf.—Snyder Co.: in Penn's Creek at the "Swinging Bridge," Selinsgrove, *4209*.

Potamogeton pusillus L.—Snyder Co.: in Penn's Creek at the "Swinging Bridge," Selinsgrove, *4210*.

COMMELINACEAE

Commelina communis L.—Chester Co.: very abundant on roadside banks, Brandywine Creek, Lenape, *13873*.

Cyanotis somaliensis C. B. Clarke—Warren Co.: in indoor cultivation, Warren, *14479*, det. Bailey.

Tradescantia fluminensis Vell.—Snyder Co.: in indoor cultivation, Selinsgrove, *3185*. Warren Co.: in indoor cultivation and becoming a weed under greenhouse benches, Warren, *14573*, verif. Bailey.

Tradescantia fluminensis var. *albo-vittata* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *14714*, verif. Bailey.

Tradescantia fluminensis var. *aurea* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *16144*, verif. Bailey.

Tradescantia fluminensis var. *variegata* L. H. Bailey—Warren Co.: in indoor cultivation and weed under greenhouse benches, North Warren, *14717*, verif. Bailey.

Zebrina pendula Schnitzl.—Warren Co.: in indoor cultivation and spreading as a weed under greenhouse benches, North Warren, *14718*, verif. Bailey.

MUSACEAE

Musa paradisiaca var. *sapientum* (L.) Kuntze—Warren Co.: in indoor cultivation, North Warren, *15250*, verif. Bailey, *16184*, verif. Bailey.

ZINGIBERACEAE

Zingiber zerumbet (L.) Rosc.—Warren Co.: in indoor cultivation, North Warren, *14606*, cited as "*Bambusa* sp." on page 31 of the Observed Flora of Warren, *16135*, det. Alexander, who says "appears to be the closest match for your plant. There are slight differences in pubescence."

CANNACEAE

Canna generalis L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *15661*, verif. Bailey.

Canna glauca L.—Philadelphia Co.: in outdoor cultivation, Philadelphia, *3062*.

Canna warscewiczii A. Dietr.—Warren Co.: in outdoor cultivation, North Warren, *15977*, verif. Bailey.

MARANTACEAE

Calathea zebrina Lindl.—Lackawanna Co.: in indoor cultivation, Scranton, *4236*.

Maranta leuconeura var. *kerchoveana* E. Morren—Warren Co.: in indoor cultivation, North Warren, *15079*, det. as "*M. kerchoveana* E. Morren" by Alexander.

MELANTHIACEAE

Chrosperma muscaetoxicum (Walt.) Kuntze—Clinton Co.: in open damp woodlands northwest of Hammersley Fork, *17547*.

Veratrum viride Ait.—Monroe Co.: in woods along streams, Buck Hill Falls, *2979*.

LILIACEAE

Chionodoxa luciliae Boiss.—Warren Co.: in outdoor cultivation, North Warren, *16181*, verif. Bailey.

Erythronium albidum Nutt.—Snyder Co.: in moist grassy thicket at junction of Penn's Creek and Middle Creek, Selinsgrove, *2310*. Warren Co.: in low moist woods, Warren, *14504*; in moist woods, near Kinzua, *17228*.

Erythronium americanum Ker—Potter Co.: in woodlands, Coudersport, *16274*. Snyder Co.: in moist grassy thicket at junction of Penn's Creek and Middle Creek and in woodlands, Selinsgrove, *2256*. Warren Co.: in low moist woods, Warren, *14501*; in deep woods, North Warren, *17193*.

Fritillaria imperialis L.—Perry Co.: in outdoor cultivation, Liverpool, *3139*.

Hyacinthus orientalis L.—Snyder Co.: in indoor and outdoor cultivation, Selinsgrove, *2246*. Warren Co.: in outdoor cultivation, North Warren, *16182*, verif. Bailey.

Hyacinthus orientalis var. *albulus* J. G. Baker—Snyder Co.: in outdoor cultivation, Selinsgrove, *2787*. Warren Co.: in outdoor cultivation, North Warren, *16185*, verif. Bailey.

Lilium bulbiferum L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2468*.

Lilium canadense f. *rubrum* N. L. Britton—Warren Co.: abundant in moist grassy fields about 2 miles west of Warren, *15177*; in meadows, North Warren, *17766*.

Lilium humboldtii Roezl. & Leicht.—Warren Co.: in outdoor cultivation, North Warren, *15366*, verif. Bailey.

Lilium longiflorum var. *eximium* Nichols.—Snyder Co.: in indoor cultivation, Selinsgrove, *2276*.

Lilium philadelphicum L.—Potter Co.: in open woodlands, Cross Fork, Stewardson Township, *16558*.

Lilium regale E. H. Wils.—Warren Co.: in outdoor cultivation, North Warren, *15083*, verif. Bailey.

Lilium superbum L.—Warren Co.: in meadows, North Warren, *16538*; in grassy meadows between Irvington and Tideoute, *17502*; in moist meadows and thickets, Sheffield, *17854*.

Lilium tigrinum H. C. Andr.—Potter Co.: in outdoor cultivation, Coudersport, *16695*, verif. Bailey. Warren Co.: in outdoor cultivation, North Warren, *15142*; along railroad embankments about 2 miles west of Warren, *15175*.

Lilium tigrinum var. *plenescens* Waugh—Warren Co.: in outdoor cultivation, North Warren, *15527*, verif. Bailey.

Muscari botryoides Mill.—Warren Co.: in outdoor cultivation, North Warren, *16209*, verif. Bailey.

Ornithogalum nutans L.— Snyder Co.: in outdoor cultivation, Selinsgrove, *3164*.

Ornithogalum umbellatum L.—Snyder Co.: in outdoor cultivation and widely naturalized along roadsides near Bake Oven Hill, Selinsgrove, *2393*.

Scilla hispanica Mill.—Warren Co.: in outdoor cultivation, North Warren, *16233*, verif. Bailey.

Scilla hispanica var. *alba* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *16231*, verif. Bailey.

Scilla nonscripta Hoffm. & Link—Warren Co.: in outdoor cultivation, North Warren, *16230*, verif. Bailey.

Tulipa elegans J. G. Baker—Snyder Co.: in outdoor cultivation, Selinsgrove, *2333*, cited as "*T. elegans* Hort." on page 27 of the Annotated List and so distributed.

Tulipa gesneriana L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2277*, cited as "*T. gesneriana* var. *hybrida* Hort." on page 27 of the Annotated List and so distributed. Warren Co.: in outdoor cultivation, North Warren, *14593*, verif. Bailey.

Tulipa gesneriana var. *darwini* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *14729*, verif. Bailey.

Tulipa gesneriana var. *dracontia* J. G. Baker—Warren Co.: in outdoor cultivation, North Warren, *14730*, verif. Bailey.

Tulipa gesneriana var. *lutea* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *16219*, verif. Bailey.

Tulipa gesneriana var. *plenescens* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *16190* (type), verif. Bailey.

Tulipa gesneriana var. *rosea* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *16220*, verif. Bailey.

Tulipa sylvestris L.—Warren Co.: in outdoor cultivation, North Warren, *16210*, verif. Bailey.

CONVALLARIACEAE

Agapanthus africanus Hoffmgg.—Warren Co.: in indoor cultivation, North Warren, *15132*, verif. Bailey.

Asparagus asparagoides (Willd.) Wight—Snyder Co.: in indoor cultivation, Selinsgrove, *2764*, cited as "*A. asparagoides* Wight" on page 27 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *16113*, verif. Bailey.

Asparagus officinalis var. *altilis* L.—Warren Co.: in outdoor cultivation and widely escaped, North Warren, *15522*, verif. Bailey.

Asparagus plumosus J. G. Baker—Warren Co.: in indoor cultivation, North Warren, *15523*, verif. Bailey.

Asparagus sprengeri Regel—Snyder Co.: in indoor and summer outdoor cultivation, Selinsgrove, *2779*. Warren Co.: in indoor cultivation, Warren, *14553*, verif. Bailey.

Aspidistra elatior Blume—Warren Co.: in indoor cultivation, North Warren, *15071*, verif. Bailey.

Chlorophytum elatum R. Br.—Warren Co.: in indoor cultivation, North Warren, *14990*, verif. Bailey.

Chlorophytum elatum var. *picturatum* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *15088*, verif. Bailey.

Chlorophytum elatum var. *variegatum* Free—Philadelphia Co.: in indoor cultivation, Philadelphia, *3064*, cited as "var. *variegatum* Hort." on page 27 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *16422*, verif. Bailey.

Chlorophytum elatum var. *vittatum* (L. H. Bailey) Moldenke—Potter Co.: in indoor cultivation, Coudersport, *16158*, verif. Bailey.

Clintonia borealis (Ait.) Raf.—Lycoming Co.: in woods along roadsides, near Williamsport, *3181*. Potter Co.: in woodlands, Eulalia Township, *16229*. Warren Co.: in dense woods, North Warren, *15711*.

Convallaria majalis L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2338*. Warren Co.: in outdoor cultivation, tending to become naturalized, North Warren, *14662*, verif. Bailey.

Disporum lanuginosum (Michx.) Nichols.—Fayette Co.: in woods, South Connellsville, *3834*. Warren Co.: in dense woodlands, Sheffield, *17354*; in woods, North Warren, *17387*.

Hemerocallis flava L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2447*. Warren Co.: in outdoor cultivation and persistent, North Warren, *15035*, verif. Bailey.

Hemerocallis fulva L.—Warren Co.: in outdoor cultivation, persistent, and widely naturalized, North Warren, *15160*, verif. Bailey.

Hemerocallis fulva var. *kwanso* Regel—Warren Co.: in outdoor cultivation, persistent, and naturalized, North Warren, *15401*, verif. Bailey.

Hosta caerulea Tratt.—Warren Co.: in outdoor cultivation, North Warren, *15302*, verif. Bailey.

Hosta lancifolia var. *undulata* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *15148*, verif. Bailey.

Hosta plantaginea (Lam.) Aschers.—Warren Co.: in outdoor cultivation, North Warren, *15762*, verif. Bailey.

Hosta sieboldiana (Hook.) Engl.—Warren Co.: in outdoor cultivation, North Warren, *15119*, verif. Bailey.

Kniphofia uvaria Hook.—Warren Co.: in outdoor cultivation, North Warren, *15239*, verif. Bailey.

Maianthemum canadense Desf.—Potter Co.: in moist woods, Coudersport, *16282*. Snyder Co.: in woods along road to Penn Avon, Selinsgrove, *2444*. Warren Co.: in damp woodlands, North Warren, *14673*, *16249*; in woodlands, Warren, *14796*.

Maianthemum canadense f. *trifolium* (Farwell) Vict.—Potter Co.: in moist woods, Coudersport, *16283*. Warren Co.: in woodlands, Warren, *14797*; in damp woods, North Warren, *16250*.

Oakesiella sessilifolia (L.) Small—Snyder Co.: in woodland along trolley tracks, Selinsgrove, *2340*, distributed as "*Uvularia sessilifolia* L." Warren Co.: in sunny places, Warren, *14526*; in dense woodlands, North Warren, *14686*, *15448*, *15471*; in woodlands, near Kinzua, *17210*.

Polygonatum biflorum (Walt.) Ell.—Warren Co.: in wet woods, North Warren, *16238*.

Polygonatum canaliculatum (Muhl.) Pursh—Snyder Co.: in moist ground along old canal-bed, Selinsgrove, *4533*, cited as "*P. commutatum* (R. & S.) Dietr." on page 28 of the Annotated List and so distributed. Warren Co.: in thickets, wet woods, and outdoor cultivation, North Warren, *15120*, verif. Bailey, *16239*, *17398*.

Polygonatum pubescens (Willd.) Pursh—Potter Co.: in moist woodlands, Coudersport, *16418*. Snyder Co.: along old canal-bed, Selinsgrove, *1988*, cited as "*P. biflorum* (Walt.) Ell." on page 28 of the Annotated List and so distributed. Warren Co.: in woodlands, near Kinzua, *17215*; in thickets, North Warren, *17397*.

Sansevieria thyrsiflora Thunb.—Snyder Co.: in indoor cultivation, Selinsgrove, *2854*. Warren Co.: in indoor cultivation, North Warren, *14908*, verif. Bailey.

Smilacina racemosa (L.) Desf.—Potter Co.: in woodlands, Coudersport, *16295*. Snyder Co.: on hillside beyond Bake Oven Hill, Selinsgrove, *2418*, distributed as "*Vagnera racemosa* (L.) Morong." Warren Co.: in damp woodlands, Warren, *14774*; in dense or in open woodlands, damp thickets, and on wooded banks of Conewango Creek, North Warren, *15474*, *16253*, *17399*, *17400*, *17862*.

Smilacina stellata (L.) Desf.—Warren Co.: in dense woodlands, North Warren, *15608*.

Streptopus roseus Michx.—Clearfield Co.: in cold damp woods, Ott's Run, *14493*. Warren Co.: in dense woodlands, North Warren, *15440*, *15592*; in moist woods, near Sheffield, *16327*; in dense woods, near Kinzua, *17223*.

Tortipes amplexifolius (L.) Small—Monroe Co.: along edge of creek, Buck Hill Falls, *2966*, distributed as "*Streptopus amplexifolius* (L.) DC."

Uvularia grandiflora J. E. Sm.—Warren Co.: in moist woods, Warren, *14517*, *14784*; in dense woodlands, North Warren, *15580*.

Uvularia perfoliata L.—Snyder Co.: in moist woods beyond railroad tracks, Selinsgrove, *2378*. Warren Co.: in sunny places in woods, Warren, *14525*.

Xeniatrum umbellulatum (Michx.) Small—Clearfield Co.: in dark woods, Du Bois, *3209*, distributed as "*Clintonia umbellata* (Michx.) Torr." Warren Co.: in dense damp woods, North Warren, *14887*, *16252*, *16502*, *17679*.

ALOACEAE

Aloë ciliaris Haw.—Warren Co.: in indoor cultivation, North Warren, *16006*, verif. Bailey.

Aloë variegata L.—Dauphin Co.: in indoor cultivation, Berrysburg, *3129*.

Gasteria maculata Haw.—Warren Co.: in indoor cultivation, Warren, *14834*, det. Bailey.

Gasteria verrucosa Duval—Warren Co.: in indoor cultivation, North Warren, *16161*, verif. Bailey.

TRILLIACEAE

Medeola virginiana L.—Northumberland Co.: in woods on Montour Ridge, Northumberland, *2446*. Warren Co.: in dense woodlands, North Warren, *15671*.

Trillium erectum L.—Potter Co.: in woods, Coudersport, *16290*. Snyder Co.: in woods on mountainside at edge of Middle Creek, Selinsgrove, *2454*. Warren Co.: in rich woods, Jackson Run, North Warren, *14492*; in woodlands, North Warren, *14678*, *17204*.

Trillium erectum var. *flavum* Torr.—Warren Co.: in rich woods, Warren, *14516*.

Trillium grandiflorum (Michx.) Salisb.—McKean Co.: in woods, near Eldred, *16284*. Snyder Co.: in dark woods along brookside in Aqueduct Hollow, Selinsgrove, *2329*. Warren Co.: in rich moist woods, Warren, *14514*, *14515*; in woodlands, North Warren, *17205*.

Trillium undulatum Willd.—Potter Co.: in woodlands, Coudersport, *16292*. Snyder Co.: in dark woods at Tall Timbers, Troxelville, *2440*. Warren Co.: in low moist woods, Jackson Run, North Warren, *14491*; in dense woodlands, North Warren, *14672*, *15715*; in dense woods, Deerlick road, near Sheffield, *17268*.

SMILACACEAE

Nemexia ecirrhata (Engelm.) Small—Warren Co.: in dense damp woodlands, North Warren, *15679*, *17699*.

Nemexia herbacea (L.) Small—Warren Co.: at edge of woods about 2 miles west of Warren, *15176*; at edge of woodlands and scrambling over vegetation along fencerows, North Warren, *15281*, *15706*.

Smilax hispida Muhl.—Snyder Co.: in woodlands near the "Swinging Bridge," Selinsgrove, *4199*. Warren Co.: in dense woodlands, North Warren, *15701*.

Smilax rotundifolia L.—Northumberland Co.: on hillside along road to Ashland, Mt. Carmel, *2501*.

ARACEAE

Acorus calamus L.—Snyder Co.: in marsh along road to Kratzerville, Penn Avon, *2314*. Warren Co.: in wet marshy soil, North Warren, *15282*.

Anthurium andreanum Linden—Philadelphia Co.: in indoor cultivation, Philadelphia, *3060*.

Arisaema atrorubens var. *zebrinum* (Sims) Fernald—Warren Co.: in woods near Sheffield, *16328*.

Arisaema triphyllum (L.) Schott—Snyder Co.: in moist woods on hillside, Selinsgrove, *2335*.

Monstera deliciosa Liebm.—Warren Co.: in indoor cultivation, North Warren, *14944*, verif. Bailey.

Muricauda dracontium (L.) Small—Warren Co.: in marshy ground, North Warren, *17833*.

Orontium aquaticum L.—Snyder Co.: in mud at edge of Middle Creek near Bake Oven Hill, Selinsgrove, *2281*.

Philodendron cordatum (Vell.) Kunth—Warren Co.: in indoor cultivation, North Warren, *16001*, det. Alexander, det. as "*Scindapsus aureus*, Engl." by Bailey and cited as "*Scindapsus aureus* var. *viridis* Moldenke" on page 29 of the Observed Flora of Warren.

Scindapsus aureus A. Engl.—Warren Co.: in indoor cultivation, North Warren, *15989*, det. Bailey.

Symplocarpus foetidus (L.) Nutt.—Warren Co.: in marshy ground, North Warren, *16777*.

Xanthosoma sagittifolium Schott—Warren Co.: in indoor cultivation, North Warren, *16009*, verif. Bailey.

Zantedeschia aethiopica Spreng.—Snyder Co.: in indoor cultivation, Selinsgrove, *2326*. Warren Co.: in indoor cultivation, Warren, *14836*, verif. Bailey.

Zantedeschia elliottiana A. Engl.—Warren Co.: in indoor cultivation, North Warren, *15123*, verif. Bailey.

LEMNACEAE

Lemna minor L.—Snyder Co.: in pool of stagnant water along Middle Creek, Selinsgrove, *3824*.

SPARGANIACEAE

Sparganium androcladum (Engelm.) Morong—Warren Co.: in marshes, Chandler's Valley, *17816*; in marshes, North Warren, *17933*; in swamps, near Sheffield, *18204*.

Sparganium eurycarpum Engelm.—Warren Co.: in marshes between Warren and Russell, *17882*.

TYPHACEAE

Typha latifolia L.—Warren Co.: in wet ditches and swamps, North Warren, *15541*.

AMARYLLIDACEAE

Clivia miniata (Hook.) Regel—Warren Co.: in indoor cultivation, North Warren, *15972*, det. Bailey.

Galanthus nivalis L.—Warren Co.: in outdoor cultivation, North Warren, *16174*, det. Bailey, distributed as "*Leucojum vernum* L."

Hippeastrum puniceum Urb.—Warren Co.: in indoor cultivation, North Warren, *16123*, verif. Bailey.

Hippeastrum vittatum Herb.—Warren Co.: in indoor cultivation, North Warren, *16175*, verif. Bailey, *17090*.

Hymenocallis caribaea Herb.—Lackawanna Co.: in indoor cultivation, Scranton, *4237*.

Hymenocallis occidentalis (Le Conte) Kunth—Philadelphia Co.: in indoor cultivation, Philadelphia, *3061*.

Leucojum aestivus L.—Snyder Co.: in outdoor cultivation and escaped, Freeburg, *3163*.

Lycoris squamigera Maxim.—Warren Co.: in outdoor cultivation, North Warren, *15531*, verif. Bailey.

Narcissus poeticus L.—Warren Co.: in outdoor cultivation, North Warren, *16226*, verif. Bailey.

Narcissus poeticus var. *ornatus* L. H. Bailey—Warren Co.: in outdoor cultivation, North Warren, *14608*, verif. Bailey.

Narcissus poeticus var. *plenus* Pugsley—Warren Co.: in outdoor cultivation, North Warren, *14842*, verif. Bailey.

Narcissus pseudo-narcissus L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16176*, verif. Bailey.

Narcissus pseudo-narcissus var. *bicolor* J. G. Baker—Warren Co.: in outdoor cultivation, North Warren, *16179*, verif. Bailey.

Narcissus pseudo-narcissus f. *plenus* Moldenke—Warren Co.: in outdoor cultivation, North Warren, *16178*, cited as "f. *pleniflorus* Moldenke" on page 29 of the Observed Flora of Warren and so distributed and verified by Bailey.

Sprekelia formosissima Herb.—Warren Co.: in indoor cultivation, North Warren, *14989*, det. Bailey.

ALLIACEAE

Allium cepa L.—Warren Co.: in outdoor cultivation and escaped in trash piles, North Warren, *17473*.

Allium cernuum Roth—Bedford Co.: along roadsides, Bedford Springs, *3360*.

Allium neopolitanum Cirillo—Warren Co.: in indoor cultivation, North Warren, *16162*, verif. Bailey.

Allium porrum L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *16109*, verif. Bailey.

Allium schoenoprasum L.—Lackawanna Co.: in outdoor cultivation, Scranton, *3892*. Warren Co.: in outdoor cultivation, North Warren, *15019*, verif. Bailey.

Allium vineale L.—Warren Co.: in waste ground and fields, North Warren, *16450*.

Validallium tricoccum (Ait.) Small—Potter Co.: in woodlands, Coudersport, *16567*; in beech-birch-maple forest, with some hemlock, heavily covered with hardwood leaves, Eulalia Township, *17065*. Warren Co.: in indoor cultivation, North Warren, *16270*; in dense woods, near Kinzua, *17217*.

IRIDACEAE

Crocus susianus Ker—Snyder Co.: in outdoor cultivation in lawns, Selinsgrove, *2242*.

Crocus vernus All.—Snyder Co.: in outdoor cultivation in lawns, Selinsgrove, *2243*. Warren Co.: in outdoor cultivation, North Warren, *14732*, verif. Bailey.

Freesia hybrida L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *16128*, verif. Bailey.

Freesia refracta var. *alba* J. G. Baker—Warren Co.: in indoor cultivation, North Warren, *16130*, verif. Bailey.

Gladiolus hortulanus L. H. Bailey—Warren Co.: in indoor and outdoor cultivation, North Warren, *15075*, verif. Bailey.

Iris germanica L.—Snyder Co.: in outdoor cultivation and escaped in trash piles, Selinsgrove, *2348*. Warren Co.: in outdoor cultivation and escaped, North Warren, *14991*, verif. Bailey.

Iris germanica var. *florentina* (L.) L. H. Bailey—Snyder Co.: in outdoor cultivation, Selinsgrove, *2408*, cited as "*I. florentina* L." on page 30 of the Annotated List. Warren Co.: in outdoor cultivation and escaped along streambanks, North Warren, *16259*, verif. Bailey.

Iris kaempferi Sieb.—Warren Co.: in outdoor cultivation, North Warren, *15004*, *15156*, verif. Bailey, *16261*, det. Alexander.

Iris orientalis Mill.—Lackawanna Co.: in outdoor cultivation, Scranton, *6498*.

Iris pseudacorus L.—Warren Co.: in outdoor cultivation, North Warren, *14904*, verif. Bailey, *15005*, *16254*, verif. Bailey, *16260*, det. Alexander; in marshes, Deerlick, near Sheffield, *16303*.

Iris pumila L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *3158*.

Iris tingitana Boiss. & Reut.—Warren Co.: in indoor cultivation, North Warren, *14910*, verif. Bailey.

Iris versicolor L.—Snyder Co.: in old canal-bed, Selinsgrove, *2478*.

Iris virginica var. *shrevei* (Small) E. Anderson—McKean Co.: in marshes, Burtville, *16412*. Warren Co.: in marshes and in moist soil along edge of Conewango Creek, North Warren, *15564*, *16372*.

Iris xiphioides Ehrh.—Warren Co.: in outdoor cultivation, North Warren, *16243*, det. Alexander.

Ixia speciosa H. C. Andr.—Warren Co.: in indoor cultivation, North Warren, *16168*, verif. Bailey.

Neomarica northiana (Schneev.) Sprague—Perry Co.: in indoor cultivation, Blain, *3869*, distributed as "*Iris foliosa* Mackenzie & Bush." Warren Co.: in indoor cultivation, North Warren, *15081*, verif. Bailey.

Sisyrinchium graminoides Bicknell—Potter Co.: in grassy fields and meadows, Coudersport, *16395*, *17535*. Warren Co.: in grassy fields, North Warren, *16433*; in grassy meadows between Irvington and Tideoute, *17486*.

DIOSCOREACEAE

Dioscorea batatas Decaisne—Snyder Co.: in outdoor cultivation, Selinsgrove, *3556*. Warren Co.: in outdoor cultivation, North Warren, *15242*, verif. Bailey.

Dioscorea villosa L.—Warren Co.: climbing over shrubs at margins of woods and along woodland roads, North Warren, *15482*, *17697*.

AGAVACEAE

Agave americana L.—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *14727*, verif. Bailey.

Agave americana var. *marginata* Trelease—Snyder Co.: in indoor cultivation, Selinsgrove, *2853*, cited as "var. *striata* Hort." on page 29 of the Annotated List and so distributed. Warren Co.: in indoor cultivation, North Warren, *14978*, cited as "var. *variegata* L. H. Bailey" on page 30 of the Observed Flora of Warren and so distributed and verified by Bailey.

Polianthes tuberosa L.—Snyder Co.: in outdoor cultivation, Selinsgrove, *2741*.

DRACAENACEAE

Cordyline australis (Forst.) Hook. f.—Lackawanna Co.: in indoor cultivation, Scranton, *4214*, cited as "*C. australis* Hook. f." on page 28 of the Annotated List and so distributed. Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15089*, *16024*, verif. Bailey.

Dracaena fragrans Ker—Warren Co.: in indoor and summer outdoor cultivation, North Warren, *15054*, verif. Bailey, *16132*, verif. Bailey.

Dracaena fragrans var. *massangeana* E. Morren—Lackawanna Co.: in indoor cultivation, Scranton, *4215*, cited as "var. *massangeana* Hort." on page 28 of the Annotated List and so distributed.

Dracaena godseffiana Sander—Lackawanna Co.: in indoor cultivation, Scranton, *4216*.

Taetsia terminalis (L.) W. F. Wight—Warren Co.: in indoor cultivation, North Warren, *16300*, distributed as "*Cordyline terminalis* (L.) Kunth" and so verif. by Bailey.

Taetsia terminalis var. *albolineata* Hort.—Lackawanna Co.: in indoor cultivation, Scranton, *4223*, cited as "*Cordyline terminalis* var. *albolineata* Hort." on page 28 of the Annotated List and so distributed.

Taetsia terminalis var. *elegans* Hort.—Lackawanna Co.: in indoor cultivation, Scranton, *4220*, cited as "*Cordyline terminalis* var. *elegans* Hort." on page 28 of the Annotated List and so distributed.

Taetsia terminalis f. **metallica** (E. Morren) Moldenke, comb. nov. *Cordyline metallica* E. Morren, Belg. Hort. **22**:353. 1872.—Lackawanna Co.: in indoor cultivation, Scranton, *4218*, cited as "*Cordyline terminalis* var. *metallica* Hort." on page 28 of the Annotated List and so distributed.

Taetsia terminalis f. **nigrorubra** (L. H. Bailey) Moldenke, comb nov. *Cordyline nigrorubra* L. H. Bailey, Hortus 175. 1935.—Lackawanna Co.: in indoor cultivation, Scranton, *4217*, cited as "*Cordyline terminalis* var. *nigrorubra* Hort." on page 28 of the Annotated List and so distributed.

Yucca filamentosa L.—Warren Co.: in outdoor cultivation, North Warren, *14854*, verif. Bailey.

ARECACEAE

Phoenix dactylifera L.—Warren Co.: in indoor cultivation, North Warren, *16154*, verif. Bailey.

Syagrus weddelliana (Wendl.) Becc.—Snyder Co.: in indoor cultivation, Selinsgrove, *2770*, distributed as "*Cocos weddelliana* Wendl."

PANDANACEAE

Pandanus veitchi Dall.—Warren Co.: in indoor cultivation, North Warren, *15072*, verif. Bailey, *16101*, verif. Bailey.

CYCLANTHACEAE

Carludovica palmata Ruíz & Pav.—Snyder Co.: in indoor cultivation, Selinsgrove, *4245*.

HYPOXIDACEAE

Curculigo capitulata (Lam.) Kuntze—Lackawanna Co.: in indoor cultivation, Scranton, *4244*, distributed as "*C. recurvata* Dry."

Hypoxis hirsuta (L.) Coville—Snyder Co.: in woods on Montour Ridge, near Selinsgrove, *2412*.

ORCHIDACEAE[13]

Blephariglottis psycodes (L.) Rydb.—Warren Co.: in wet ditches along roadside, North Warren, *16612*.

Corallorrhiza maculata Raf.—Monroe Co.: in dark woods, Buck Hill Falls, *2987*. Warren Co.: in dense woodlands, North Warren, *15588*, det. Schweinfurth, *15589*, det. Schweinfurth, *15683*, verif. Schweinfurth; in dense woods, near Brookston, *18020*.

Cypripedium calceolus var. *pubescens* (Willd.) Corr.—Warren Co.: in cold woods, Warren, *14533*, det. Schweinfurth; in dense woods, North Warren, *15607*, det. Schweinfurth.

Epipactis latifolia (Huds.) All.—Warren Co.: very abundant in shady thickets and roadsides along Conewango Creek, North Warren, *15618*, det. as "*E. latifolia* All." by Schweinfurth, *16488*, *17774a*.

Fissipes acaulis (Ait.) Small—Warren Co.: in cold woods, Warren, *14529*, det. as "*Cypripedium acaule* Ait." by Schweinfurth; in dense leaf-mold in woodlands, North Warren, *15460*.

Galeorchis spectabilis (L.) Rydb.—Dauphin Co.: in woods, Harrisburg, *1968*.

Goodyera pubescens (Willd.) R. Br.—Potter Co.: in hemlock woods, Coudersport, *16273*, *16411*. Warren Co.: in evergreen woods, North Warren, *16655*.

Isotria verticillata (Willd.) Raf.—Snyder Co.: in woods, Selinsgrove, *3102*.

Lysias orbiculata (Pursh) Rydb.—Warren Co.: in dense woodlands, North Warren, *15571*, det. as "*Habenaria orbiculata* (Pursh) Torr." by Schweinfurth.

Spiranthes cernua (L.) L. C. Rich.—Monroe Co.: in meadows, Lutherland, Pocono Mountains, *10719*. Warren Co.: in moist meadows one mile southwest of Sheffield, *17005*; in marshy meadows along Four Mile Creek, *18038*.

JUNCACEAE

Juncus aristulatus Michx.—Snyder Co.: in swampy ground near roadside, Salem, *3231*.

Juncus effusus L.—Snyder Co.: in marshy ground near Bake Oven Hill, Selinsgrove, *2379*.

Juncus effusus var. *solutus* Fernald & Wiegand—Warren Co.: in wet ditches, North Warren, *15284*; in moist ditches, Deerlick, near Sheffield, *16308*; in swamps, Bull Hill, Sheffield, *17458*; in marshes, Sandstone Springs, *17597*; in marshes between North Warren and Russell, *17885*.

Juncus macer S. F. Gray—Potter Co.: in roadways and fields, Coudersport, *16413*. Warren Co.: in waste and cultivated ground and roadways, North Warren, *14977*; on paths and along roadsides, Sandstone Springs, *17612*; in dry ground and roadways along Four Mile Creek, *18050*.

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13 The *Blephariglottis lacera* (Michx.) Farwell erroneously recorded from Pennsylvania on page 31 of the Annotated List, based on number *3327*, was actually collected in New Jersey.

Luzula carolinae var. *saltuensis* (Fernald) Fernald—Warren Co.: in thickets, near Kinzua, *17214;* in woods, Cranbrook Farm, North Warren, *17334.*

Luzula multiflora (Ehrh.) Lejeune—Fayette Co.: along bank of creek, South Connellsville, *3833,* distributed as "*Juncoides campestre* (L.) Kuntze" and cited as "*L. campestris* var. *multiflora* (Ehrh.) Celak." on page 26 of the Annotated List. Warren Co.: on banks along old wood roads, Warren, *14792;* in grassy swale in woodland along Conewango Creek between North Warren and Russell, *17569.*

CYPERACEAE

Carex albursina Sheldon—Snyder Co.: along old canal-bed, Selinsgrove, *3846.*

Carex arcta Boott—Warren Co.: in marsh, North Warren, *16367.*

Carex bromoides Schk.—Warren Co.: in woods, Sheffield, *17371,* det. Core; in marshy thickets, North Warren, *17409,* det. Core.

Carex bullata Schk.—Lackawanna Co.: in swamp on Bald Mountain, Scranton, *6511.*

Carex camporum Mackenzie—Snyder Co.: along roadsides near Hoover's Landing, Selinsgrove, *3153.*

Carex caroliniana Schwein.—Snyder Co.: in moist meadows, near Selinsgrove, *3204.*

Carex cephalophora Muhl.—Snyder Co.: along roadside near woodlands, Selinsgrove, *3182.*

Carex communis L. H. Bailey—Snyder Co.: along banks of Middle Creek, Selinsgrove, *3183.* Warren Co.: in woods, Sheffield, *17370,* det. Core.

Carex crinita Lam.—Warren Co.: in moist ditches, Deerlick, near Sheffield, *16306;* in wet ditches, near Sheffield, *16333.*

Carex cristatella N. L. Britton—Warren Co.: in dry creek-beds, North Warren, *17986.*

Carex diandra Schrank—Snyder Co.: in wet soil near Bake Oven Hill, Selinsgrove, *3854.*

Carex digitalis Willd.—Snyder Co.: in woods near red pine grove, Selinsgrove, *3853.* Warren Co.: in woods, Cranbrook Farm, North Warren, *17290.*

Carex flava L.—Snyder Co.: in marshy ground, Penn Avon, *2313.*

Carex gracillima Schwein.—Snyder Co.: in wet meadows near Middle Creek, Selinsgrove, *3821.*

Carex grayii Carey—Snyder Co.: along trolley-tracks near power house, Selinsgrove, *3200,* distributed as "*C. asagrayi* Bailey."

Carex grisea Wahl.—Snyder Co.: at edge of woods along banks of Middle Creek, Selinsgrove, *3174.*

Carex howei Mackenzie—Warren Co.: in woods, Cranbrook Farm, North Warren, *17291.*

Carex intumescens Rudge—Warren Co.: in moist spots in woods, North Warren, *17841,* det. Core; at edge of marshy woods between North Warren and Russell, *17888,* det. Core; in marshes, near Sheffield, *18205,* det. Core.

Carex lacustris Willd.—Snyder Co.: in moist soil along Penn's Creek at the "Cut," Selinsgrove, *3848.*

Carex laxiflora Lam.—Warren Co.: on bank along roadside, Warren, *14766,* det. Core; in woods, Sheffield, *17372,* det. Core, *17373,* det. Core.

Carex lenticularis Michx.—Snyder Co.: in moist creek-bottom, Selinsgrove, *2862.*

Carex lupuliformis Sartwell—Warren Co.: in marshes, North Warren, *16361.*

Carex lupulina Muhl.—Forest Co.: in marshes along Tionesta Creek from Henry's Mills to Kelletville, *17365,* verif. Core. Snyder Co.: in marshy meadow, Selinsgrove, *2968.* Warren Co.: in wet ditches and marshes, near Sheffield, *16329, 18206,* det. Core; at edge of marsh between North Warren and Russell, *17886,* det. Core.

Carex lurida Wahl.—Warren Co.: in moist meadows, Bull Hill, Sheffield, *17456,* det. Core; in meadows, Sandstone Springs, *17615,* det. Core; in marshes between North Warren and Russell, *17887,* verif. Core.

Carex nigromarginata Schwein.—Snyder Co.: on sunny banks on side of grassy knoll west of Penn Avon, *2279.*

Carex normalis Mackenzie—Snyder Co.: along roadside near woods, Selinsgrove, *3173.*

Carex oederi Retz.—Snyder Co.: in Tall Timbers State Park, Troxelville, *3840*.

Carex pallescens L.—Lackawanna Co.: in moist meadows, Scranton, *6500*, det. Core. Snyder Co.: in meadows south of Selinsgrove, *3856*.

Carex pensylvanica Lam.—Snyder Co.: on mountainside near Hoover's Landing, Selinsgrove, *3137*, cited as "*C. pennsylvanica*" on page 21 of the Annotated List and so distributed. Warren Co.: in dense woods, North Warren, *17121*.

Carex plantaginea Lam.—Clearfield Co.: in woods, Du Bois, *3144*. Warren Co.: in moist woods, Deerlick, near Sheffield, *16317*; in dense woodlands at border of Forest County between Henry's Mills and Blue Jay, *17103*.

Carex platyphylla Carey—Snyder Co.: on mountainside near Hoover's Landing, Selinsgrove, *3138*. Warren Co.: in dense woods, North Warren, *15593*.

Carex prasina Wahl.—Snyder Co.: in wet meadows near Middle Creek, Selinsgrove, *3857*. Warren Co.: in moist ditches and in water along edges of streams, Deerlick, near Sheffield, *16302*, *17265*, verif. Core.

Carex projecta Mackenzie—Snyder Co.: along banks of Middle Creek near Bake Oven Hill, Selinsgrove, *3855*.

Carex rosaeoides E. C. Howe—Snyder Co.: along old canal-bed, Selinsgrove, *2344*.

Carex rosea Schk.—Warren Co.: in dense woodlands and along margins of streams, North Warren, *15437*, *15581*; in meadows, Sandstone Springs, *17600*, verif. Core.

Carex scoparia Schk.—Warren Co.: in wet ditches along roadsides, North Warren, *15289*; in roadside ditches, Deerlick, near Sheffield, *16304*; in moist meadows, Bull Hill, Sheffield, *17457*, verif. Core.

Carex stipata Muhl.—Warren Co.: in moist ditches, Deerlick, near Sheffield, *16307*; in wet ditches, North Warren, *17394*.

Carex swanii (Fernald) Mackenzie—Warren Co.: in thickets, near Kinzua, *17225*.

Carex torta Boott—Fayette Co.: at edge of stream, Connellsville, *6685*. Snyder Co.: in old canal-bed, Selinsgrove, *2469*. Warren Co.: in water at edge of stream, Deerlick road, near Sheffield, *17266*, det. Core.

Carex vulpinoidea Michx.—Warren Co.: in wet roadside ditches and marshes, North Warren, *15285*, *15393*, *16373*; in swamps between Sheffield and Blue Jay along the Tionesta Creek, *17591*, verif. Core; at edge of wet meadow between North Warren and Russell, *17900*, verif. Core.

Carex sp.—Warren Co.: in wet ditches, North Warren, *15286*, *15341*; in meadows, near Brookston, *18000*; in marsh on island in Conewango Creek, North Warren, *18097*.

Cyperus alternifolius L.—Warren Co.: in indoor and outdoor cultivation, North Warren, *14716*, verif. Bailey.

Cyperus alternifolius var. *gracilis* L. H. Bailey—Warren Co.: in indoor cultivation, North Warren, *15127*, verif. Bailey.

Cyperus strigosus L.—Warren Co.: in moist ditches, between railroad ties, and in marsh on island in Conewango Creek, North Warren, *15208*, verif. Core, *15360*, verif. Core, *18090*.

Dulichium arundinaceum (L.) N. L. Britton—Warren Co.: in marshes, North Warren, *16779*; in marshes between North Warren and Russell, *17884*, verif. Core; in marshy ground, Bear Lake, *18209*.

Eleocharis flaccida (Reichenb.) Urb.—Snyder Co.: in moist meadows, Selinsgrove, *4116*.

Eleocharis obtusa (Willd.) Schultes—Forest Co.: in marshes along Tionesta Creek from Henry's Mills to Kellettville, *17646*, verif. Core. Warren Co.: in wet ditches, North Warren, *15392*, verif. Core.

Eleocharis tuberculosa (Michx.) R. & S.—Clearfield Co.: in marshy meadows, Du Bois, *3232*.

Scirpus atrovirens Muhl.—Forest Co.: in marshes along Tionesta Creek from Henry's Mills to Kellettville, *17648*, verif. Core. Warren Co.: in wet ditches and along streams, North Warren, *15279*, verif. Core; in wet ditches, near Sheffield, *16334*; in marshes, Bull Hill, Sheffield, *17459*, verif. Core; in marshes, Sandstone Springs, *17601*, verif. Core; in marshes between North Warren and Russell, *17896*, verif. Core.

Scirpus atrovirens var. *georgianus* (Harper) Fernald—Warren Co.: in moist ditches along old wood roads, North Warren, *15789*, verif. Core.

Scirpus cyperinus (L.) Kunth—Warren Co.: in marshes, North Warren, *16780, 16791;* in marshes between North Warren and Russell, *17897*, verif. Core.

Stenophyllus capillaris (L.) N. L. Britton—Northumberland Co.: in dry sandy soil along roadsides, Herndon, *4198*.

POACEAE

Agropyron repens (L.) P. Beauv.—Warren Co.: in dry grassy fields, waste and cultivated ground, and roadside ditches, North Warren, *14940*, det. Chase, who comments "awned," *15008*, det. Chase, *15041*, det. Chase, *15266*, det. Chase, *16368;* in thickets along Conewango Creek between North Warren and Russell, *17581*, det. Chase; along margins of woods between Sheffield and Blue Jay, along the Tionesta Creek, *17596*, det. Chase.

Agrostis alba L.—Snyder Co.: near Selinsgrove, *5*, det. Monachino, cited as "*Calamagrostis macountiana* Vasey" on page 16 of the Annotated List and so distributed. Warren Co.: in waste ground, along roadsides, and in dry soil of old quarry, North Warren, *15063*, det. Chase, who comments "very immature," *15295*, det. Chase, *15390*, det. Chase; in grassy fields, Cornplanter, *16535*, det. Chase; in meadows between Sheffield and Blue Jay, along the Tionesta Creek, *17664;* in grassy meadows along Four Mile Creek, *18026*, det. Chase.

Agrostis altissima (Walt.) Tuckerm.—Monroe Co.: in marshy ground along roadside, Buck Hill Falls, *2998*.

Agrostis capillaris L.—Snyder Co.: in lawns, Selinsgrove, *2390*.

Agrostis hyemalis (Walt.) B.S.P.—Warren Co.: in dry soil of quarry, North Warren, *15391*, det. as "*A. hiemalis*" by Chase.

Agrostis perennans (Walt.) Tuckerm.—Warren Co.: in dense woodlands and thickets, North Warren, *15458*, det. Chase, *15861*, det. Chase, *18162*, det. Chase; in thickets one mile southwest of Sheffield, *17006*, verif. Chase; on road bank in open woods, Deerlick road, Sheffield, *17709*, det. Chase; in grassy meadows along Four Mile Creek, *18027*, det. Chase, *18046*, det. Chase.

Agrostis tenuis Sibth.—Warren Co.: in waste cultivated ground, North Warren, *17756*.

Aira flexuosa L.—Lackawanna Co.: in waste ground along city streets, Scranton, *6502*, det. Hitchcock, distributed as "*Weingaertneria canescens* (L.) Bernh."

Andropogon furcatus Muhl.—Snyder Co.: along roadsides near the electric-power dam, Selinsgrove, *4180*.

Anthoxanthum odoratum L.—Warren Co.: in grassy fields, Warren, *14789*, det. Chase; in grassy fields, Sheffield, *17356*.

Aspris caryophyllea (L.) Nash—Snyder Co.: in dry lawns, Selinsgrove, *2849*.

Avena sativa L.—Warren Co.: in outdoor cultivation and escaped along roadsides, North Warren, *15201*, verif. Bailey, *15777*, verif. Chase; escaped along roadsides, Bull Hill, Sheffield, *17721*.

Brachyelytrum erectum (Schreb.) P. Beauv.—Warren Co.: in thickets, margins of woods, and dense woodlands, North Warren, *15423*, verif. Chase, *16247*, det. Chase; in meadows, Sandstone Springs, *17599*, det. Chase.

Bromus ciliatus L.—Snyder Co.: in fields along old canal-bed on Isle of Que, Selinsgrove, *3108*, det. Gleason, cited as "*Melica nitens* Nutt." on page 17 of the Annotated List and so distributed. Warren Co.: along edge of woodlands and in moist soil at edge of Conewango Creek, North Warren, *15476*, det. Chase, *15553*, det. Chase.

Bromus commutatus Schrad.—Warren Co.: in grassy fields along the Conewango Creek between North Warren and Russell, *17578*, det. Chase.

Bromus latiglumis (Shear) A. S. Hitchc.—Warren Co.: in open woodlands, at margins of woods, and in grassy meadows, North Warren, *16648*, det. Chase, *16744*, det. Chase, *18082*, det. Chase.

Bromus mollis L.—Warren Co.: in grassy fields, North Warren, *15643*, det. Chase.

Bromus purgans L.—Snyder Co.: along roadsides in deep woods, Selinsgrove, *4204*.

Bromus racemosus L.—Warren Co.: in waste ground, North Warren, *14876*, det. Chase, who states that this is the first record of the species from Pennsylvania, *15064*, det. Chase.

Bromus secalinus L.—Snyder Co.: along roadsides near Bake Oven Hill, Selinsgrove, *3226*, det. Gleason, cited as "*Uniola latifolia* Michx." on page 20 of the Annotated List and so distributed.

Bromus tectorum L.—Warren Co.: in waste ground, roadways, and railroad embankments, North Warren, *16194*, *17806*, verif. Chase.

Cinna arundinacea L.—Warren Co.: in marshy meadows, grassy fields near streams, and moist soil along the Conewango Creek, North Warren, *15554*, det. Chase, *17834*, det. Chase, *18083*, det. Chase.

Cinna latifolia (Trevir.) Griseb.—Warren Co.: in grassy meadows along Four Mile Creek, *18023*, det. Chase, *18024*, det. Chase.

Cynosurus cristatus L.—Snyder Co.: in fields, Selinsgrove, *1983*.

Dactylis glomerata L.—Snyder Co.: in waste ground, along roadsides, and in orchards, Selinsgrove, *2441*. Warren Co.: in grassy pastures, North Warren, *14957*, det. Chase.

Danthonia compressa Austin—Warren Co.: in open woodlands, North Warren, *15792*, det. Chase.

Danthonia spicata (L.) P. Beauv.—Warren Co.: in very dry fields on hillsides, North Warren, *15785*, verif. Chase, who says "note cleistogenes"; in grassy thickets between Sheffield and Blue Jay along the Tionesta Creek, *17592*, det. Chase.

Deschampsia flexuosa (L.) Trin.—Monroe Co.: along roadsides in woods, Buck Hill Falls, *2992*.

Digitaria sanguinalis (L.) Scop.—Snyder Co.: in dry fields and gardens, Selinsgrove, *4168*, cited as "*D. ischaemum* (Schreb.) Muhl." on page 16 of the Annotated List and distributed as "*Syntherisma ischaemum* (Schreb.) Nash." Warren Co.: in lawns and waste ground, North Warren, *15011*, det. Chase, *15258*, det. Chase, *15512*, det. Chase; in waste ground, along Four Mile Creek, *18028*, verif. Chase.

Echinochloa crusgalli (L.) P. Beauv.—Warren Co.: in waste and cultivated ground, North Warren, *15010*, det. Chase, *16008*, det. Chase; in dry fields, near Brookston, *18017*, verif. Chase.

Echinochloa pungens (Poir.) Rydb.—Warren Co.: in wet ditches, along roadsides, and in waste ground, North Warren, *15698*, *16749*.

Elymus canadensis L.—Snyder Co.: along banks of Susquehanna River, Selinsgrove, *4169*. Warren Co.: along margins of wood roads, North Warren, *15491*, det. Chase, who says "very immature; awns not yet divergent."

Elymus riparius Wiegand—Warren Co.: along edge of streams, Warren, *15326*, det. Chase; in moist soil on banks of Conewango Creek, North Warren, *15555*, det. Chase, *17929*, det. Chase.

Elymus virginicus L.—Warren Co.: in moist soil near Conewango Creek, North Warren, *15562*, det. Chase.

Elymus virginicus var. *glabriflorus* (Vasey) Bush—Warren Co.: in moist ground along Conewango Creek, North Warren, *17690*, det. Chase, *17839*, det. Chase; in thickets along Four Mile Creek, *18056*, det. Chase.

Elymus virginicus var. *intermedius* (Vasey) Bush—Warren Co.: along banks of Conewango Creek, North Warren, *16649*, det. Chase; in thickets, near Brookston, *18009*, det. Chase.

Eragrostis capillaris (L.) Nees—Northumberland Co.: in dry soil along roadsides, Herndon, *4185*.

Eragrostis pectinacea (Michx.) Nees—Warren Co.: in dry soil, along roadsides, and in cinder driveways, North Warren, *15500*, verif. Chase, *15514*, verif. Chase, *15758*, det. Chase, *15773*, det. Chase, *18159*, det. Chase.

Eragrostis poaeoides (L.) P. Beauv.—Warren Co.: in dry cinders and roadways, North Warren, *15772*, det. Chase.

Festuca elatior L.—Warren Co.: in wet grassy roadside ditches, North Warren, *15039*, det. Chase, *15288*, det. Chase.

Festuca obtusa Spreng.—Warren Co.: in open ditches and along margins of woodland roads, North Warren, *15340*, det. Chase, *15473*, det. Chase.

Glyceria grandis S. Wats.—Warren Co.: in marshes between North Warren and Russell, *17883*, det. Chase.

Glyceria melicaria (Michx.) F. T. Hubb.—Monroe Co.: among rocks along roadside at edge of woods, Buck Hill Falls, *2978*, det. Monachino, cited as "*Carex aestivalis* M. A. Curtis" on page 20 of the Annotated List and so distributed. Warren Co.: in light shade along roadsides, Deerlick road, Sheffield, *17712*, det. Chase; in moist meadows, near Brookston, *18011*, det. Chase.

Glyceria striata (Lam.) A. S. Hitchc.—Warren Co.: in wet ditches and marshes, North Warren, *15273*, det. Chase; in moist ditches one mile southwest of Sheffield, *17007*; in marshes, Bull Hill, Sheffield, *17462*, verif. Chase; in muddy bank of stream between Sheffield and Blue Jay, along the Tionesta Creek, *17589*, det. Chase; in grassy fields along Four Mile Creek, *18022*, det. Chase; in marshy ground, Willow Street Run, Sheffield, *18116*, det. Chase.

Holcus sorghum var. *caffrorum* L. H. Bailey—Snyder Co.: in outdoor cultivation, Selinsgrove, *4205*.

Holcus sorghum var. *technicus* L. H. Bailey—Snyder Co.: in outdoor cultivation, Selinsgrove, *2740*.

Holcus sudanensis (A. S. Hitchc.) L. H. Bailey—Northumberland Co.: in outdoor cultivation in fields, Fisher's Ferry, *3121*, distributed as "*H. sorghum* var. *sudanensis* Hitchc."

Hordeum jubatum L.—Potter Co.: along roadsides, Coudersport, *16574*, verif. Chase.

Hystrix patula Moench—Monroe Co.: in woods along roadsides, Buck Hill Falls, *3012*. Warren Co.: in woodlands between North Warren and Russell, *17901*, verif. Chase.

Leersia oryzoides (L.) Sw.—Snyder Co.: in marshy ground, Selinsgrove, *4182*, cited as "*Homalocenchrus oryzoides* (L.) Poll." on page 17 of the Annotated List and so distributed.

Leersia virginica Willd.—Snyder Co.: along old canal-bed on Isle of Que, Selinsgrove, *3096*, cited as "*Homalocenchrus virginicus* (Willd.) Britton" on page 17 of the Annotated List and so distributed. Warren Co.: in moist ground near Conewango Creek and in moist ditches along wood roads, North Warren, *15420*, det. Chase, *15552*, verif. Chase.

Lolium multiflorum Lam.—Warren Co.: in dry soil along roadsides, ditches, and waste ground, North Warren, *15040*, det. Chase, *15062*, det. Chase, *15498*, det. Chase, *16362*; in grassy fields along Conewango Creek between North Warren and Russell, *17576*, det. Chase.

Lolium perenne L.—Snyder Co.: in lawns, Selinsgrove, *2869*. Warren Co.: in dry soil along roadsides, North Warren, *15498a*, det. Chase, *15499*, det. Chase.

Miscanthus sinensis Anderss.—Montgomery Co.: escaped along roadsides, Norristown, *13800*, det. Chase. Warren Co.: in outdoor cultivation, North Warren, *15966*, verif. Bailey.

Miscanthus sinensis var. *gracillimus* A. S. Hitchc.—Warren Co.: in outdoor cultivation, North Warren, *15961*, verif. Bailey.

Miscanthus sinensis var. *variegatus* Beal—Warren Co.: in outdoor cultivation, North Warren, *15980*, verif. Bailey.

Miscanthus sinensis var. *zebrinus* Beal—Warren Co.: in outdoor cultivation, North Warren, *15959*, verif. Bailey.

Muhlenbergia mexicana (L.) Trin.—Forest Co.: in dry woodlands, often infected by *Phyllacora vulgata*, Cook's Forest, *16798*. Warren Co.: in shaded ground, North Warren, *15950*, verif. Chase.

Muhlenbergia schreberi J. F. Gmel.—Warren Co.: in shaded ground along roadsides, waste ground along sides of buildings, and edges of lawns, North Warren, *15833*, verif. Chase.

Notholcus lanatus (L.) Nash—Warren Co.: in grassy fields, North Warren, *15020*, *15287*; in grassy meadows along Conewango Creek between North Warren and Russell, *17558*. The first two of these collections were det. as "*Holcus lanatus* L." by Chase.

Oryzopsis racemosa (J. E. Sm.) Ricker—Snyder Co.: in woods, Tall Timbers State Park, Troxelville, *3842*.

Panicum agrostoides Spreng.—Snyder Co.: along banks of Susquehanna River, Selinsgrove, *4175*.

Panicum barbulatum Michx.—Warren Co.: in dense woodlands, North Warren, *15452*, det. Chase.

Panicum capillare L.—Potter Co.: in grassy fields, Coudersport, *16714*. Warren Co.: in waste ground, North Warren, *15824*, verif. Chase.

Panicum clandestinum L.—Potter Co.: in woodlands, Coudersport, *16723*. Warren Co.: in dense woodlands and along old wood roads, North Warren, *15492*, verif. Chase, *15548*, verif. Chase; in thickets, near Brookston, *18008*, verif. Chase.

Panicum dichotomiflorum Michx.—Monroe Co.: in wet soil, Buck Hill Falls, *3008*. Warren Co.: in cinder driveways, North Warren, *18158*, det. Chase.

Panicum dichotomum L.—Warren Co.: in dark and open woods, North Warren, *16623*, verif. Chase, *16793*.

Panicum huachucae Ashe—Forest Co.: in dry soil, Cook's Forest, *16797*, det. Chase.

Panicum huachucae var. *fasciculatum* (Torr.) F. T. Hubb.—Warren Co.: in thickets, near Brookston, *18010*, det. Chase; in grassy meadows along Four Mile Creek, *18025*, det. Chase.

Panicum lanuginosum Ell.—Warren Co.: at edge of woods along Conewango Creek between North Warren and Russell, *17570*, det. Chase, who states that this is the first record of the species from the state.

Panicum latifolium L.—Warren Co.: in open woods, North Warren, *15384*, det. Chase; along banks of streams, Sandstone Springs, *17598*, verif. Chase.

Panicum meridionale Ashe—Warren Co.: in dry soil of fields, North Warren, *16602*.

Panicum virgatum L.—Snyder Co.: along roadsides, Selinsgrove, *3565*.

Panicum xanthophysum A. Gray—Clearfield Co.: in dry ground, Du Bois, *3928*.

Phalaris arundinacea L.—Monroe Co.: in shallow water. Delaware Water Cap, *2686*. Warren Co.: in moist ground along Conewango Creek, North Warren, *17692*, verif. Chase.

Phalaris arundinacea var. *picta* L.—Warren Co.: in outdoor cultivation and spreading as a weed in cultivated ground and dumps, North Warren, *14982*, verif. Bailey.

Phleum pratense L.—Warren Co.: in grassy fields, North Warren, *14988*, det. Chase, *15267*, det. Chase.

Poa alsodes A. Gray—Warren Co.: in open woodlands, Sheffield, *17344*, det. Chase, *17347*, det. Chase.

Poa annua L.—Warren Co.: in lawns and waste ground, North Warren, *14607*, *17341*, det. Chase, *17401*, det. Chase.

Poa compressa L.—Warren Co.: in grassy fields and waste ground, North Warren, *14975*, det. Chase, *15257*, det. Chase.

Poa debilis Torr.—Snyder Co.: in woods near Bake Oven Hill, Selinsgrove, *3849*.

Poa palustris L.—Warren Co.: in dense woodlands, North Warren, *15694*, det. Chase.

Poa pratensis L.—Snyder Co.: in fields and lawns, Selinsgrove, *2462*. Warren Co.: in waste and cultivated ground, North Warren, *14757*, det. Chase, *14875*, det. Chase; on top of Hill, Washington Park, Warren, *17430*, det. Chase, *17435*, det. Chase; in grassy fields along the Conewango Creek between North Warren and Russell, *17574*, det. Chase.

Poa trivialis L.—Warren Co.: in waste and cultivated ground, North Warren, *14912*, det. Chase, *14976*, det. Chase, *17446*, det. Chase.

Secale cereale L.—Snyder Co.: in outdoor cultivation and escaped along roadsides, Selinsgrove, *2377*.

Setaria italica (L.) P. Beauv.—Snyder Co.: in waste patch of formerly cultivated ground near Bake Oven Hill, Selinsgrove, *3117*, cited as "*Chætochloa italica* (L.) Scribn." on page 16 of the Annotated List and so distributed.

Setaria lutescens (Weigel) F. T. Hubb.—Warren Co.: in grassy fields and waste ground, North Warren, *15642*, verif. Chase, *18096*.

Setaria viridis (L.) P. Beauv.—Warren Co.: in dry soil along roadsides, in grassy lawns, and along sidewalks, North Warren, *15496*, verif. Chase, *16733*.

Sporobolus vaginaeflorus (Torr.) Wood—Snyder Co.: in dry sandy waste ground

along roadsides, Selinsgrove, *4200*, det. Monachino, cited as "*Aristida dichotoma* Michx." on page 15 of the Annotated List and so distributed.

Triticum aestivum L.—Snyder Co.: in outdoor cultivation in fields and escaped along roadsides on Isle of Que, Selinsgrove, *2499*. Warren Co.: in outdoor cultivation in fields and escaped in dry soil along roadsides, North Warren, *15494*, verif. Chase, *17669*; escaped in fields along Conewango Creek between North Warren and Russell, *17577*, det. Chase.

Weingaertneria canescens (L.) Bernh.—Lackawanna Co.: in waste ground along city streets, Scranton, *6505*, det. Hitchcock.

Zea mays var. *rugosa* Bonef.—Warren Co.: in outdoor cultivation and escaped, North Warren, *15319*, verif. Bailey.

Addenda

Since the preceding pages were set in type the following additional collections have been identified. Sets of the cited numbers have been deposited in the following herbaria: University of Notre Dame, Notre Dame, Indiana; Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma; and Instituto Miguel Lillo, Tucuman. Argentina. The author's sincere thanks are due to Dr. S. F. Blake for his determinations of the genus *Aster*, to Dr. H. S. Jackson for his determination in *Peniophora*, and to Dr. T. G. Yuncker for his identification of *Cuscutaceae*.

PHACIDIACEAE

Coccophacidium pini (Alb. & Schwein.) Rehm.—Warren Co.: associated with *Valsa pini* on dead limbs of *Strobus weymouthiana*, North Warren, *18228*, det. Stevenson.

VALSACEAE

Valsa pini Alb. & Schwein.—Warren Co.: associated with *Coccophacidium pini* on dead limbs of *Strobus weymouthiana*, North Warren, *18228a*, det. Stevenson.

THELEPHORACEAE

Peniophora nuda (E. Fries) Bres.—Warren Co.: on dead branches and twigs of *Hamamelis virginiana*, North Warren, *16657*, det. Jackson.

CLAVARIACEAE

Lachnocladium sp.—Warren Co.: in leafmold of woods, North Warren, *17994*, det. Stevenson.

POLYPORACEAE

Piptoporus suberosus (L.) Murrill—Warren Co.: on trunk of *Betula lutea*, North Warren, *18163*, det. as "*Polyporus betulinus* (Bull.) Fr." by Linder.

CLADONIACEAE

Cladonia chlorophaea (Floerke) Spreng.—Warren Co.: on banks in woods, near Sheffield, *18197*, det. Dix.

Cladonia cristatella Tuckerm.—Warren Co.: on banks and on floor of damp forest, near Sheffield, *18193*, det. Dix, *18198*, det. Dix, *18200*, det. Dix, *18201*, det. Dix, *18202*, det. Dix.

Cladonia cristatella f. *beauvoisii* (Del.) Vainio—Warren Co.: on floor of damp forest near Sheffield, *18194*, det. Dix.

Cladonia cristatella f. *vestita* Tuckerm.—Warren Co.: on banks and on floor of dense forest, near Sheffield, *18194a*, det. Dix, *18199*, det. Dix.

Cladonia furcata (Huds.) Schrad.—Warren Co.: on flat surfaces of rocks, near Sheffield, *18189*, det. Dix.

Cladonia pityrea var. *zwackhii* f. *subacuta* Vainio—Warren Co.: on soil of overhanging banks, North Warren, *17796*, det. Dix.

Cladonia squamosa var. *levicorticata* (Sandst.) Sandst.—Warren Co.: on banks between Sheffield and Brookston, *18145*, det. Dix.

Cladonia sp.—Warren Co.: on flat surface of rocks and on floor of damp forest, near Sheffield, *18190*, *18195*.

PARMELIACEAE

Parmelia caperata (L.) Ach.—Warren Co.: on bark of tree-trunks, near Sheffield, *18192*, det. Nearing.

Parmelia physodes (L.) Ach.—Warren Co.: on bark of tree-trunks, near Sheffield, *18191*, det. Nearing.

JUNGERMANNIACEAE

Calypogeia trichomanis (L.) Corda—Warren Co.: among needles on floor of pine woods, along Four Mile Creek, *18065*, det. Steere; on wet sandy banks between Sheffield and Brookston, *18139*, det. Steere.

Ptilidium ciliare (L.) Nees—Warren Co.: on wet sandy banks between Sheffield and Brookston, *18140*, det. Steere.

Ptilidium pulcherrimum (Web.) Hampe—Warren Co.: on wet sandy banks between Sheffield and Brookston, *18138*, det. Steere.

Trichocolea tomentella (Ehrh.) Dumort.—Warren Co.: among needles on floor of pine woods, along Four Mile Creek, *18063*, det. Steere.

SCAPANIACEAE

Scapania nemorosa (L.) Dumort.—Warren Co.: on wet sandy banks between Sheffield and Brookston, *18137*, det. Steere; on rocks, near Sheffield, *18196*, det. Steere.

SPHAGNACEAE

Sphagnum capillaceum (Weiss) Schrank—Warren Co.: in marsh between Sheffield and Brookston, *18125*, det. Andrews.

Sphagnum squarrosum (Pers.) Crome—Warren Co.: among needles on wet floor of pine woods, along Four Mile Creek, *18066*, det. as "*S. squarrosum* Crome" by Steere.

DITRICHACEAE

Ceratodon purpureus (L.) Brid.—Warren Co.: on prostrate logs in woods, Deerlick road, near Sheffield, *17254*, det. as "*C. purpureus* (Hedw.) Brid." by Steere.

DICRANACEAE

Dicranum flagellare Hedw.—Warren Co.: on prostrate decayed logs in moist woods, Deerlick road, near Sheffield, *17271*, det. Steere.

Dicranum sp.—Warren Co.: associated with *Hypnum* on prostrate logs in woods, Deerlick road, near Sheffield, *17255a*, det. Steere.

FUNARIACEAE

Funaria hygrometrica (L.) Sibth.—Warren Co.: in dense woods, Cranbrook Farm, North Warren, *17306*, det. as "*F. hygrometrica* Hedw." by Steere.

BRYACEAE

Bryum pseudotriquetrum (Hedw.) Schwaegr.—Warren Co.: on prostrate logs in moist woods, Deerlick road, near Sheffield, *17251*, det. Steere; on logs along woodland brook, Cranbrook Farm, North Warren, *17323*, det. Steere.

Bryum sp.—Warren Co.: on prostrate logs in moist woods, Deerlick road, near Sheffield, *17249*, det. Steere; on and near mossy logs in woods, Cranbrook Farm, North Warren, *17304*, det. Steere.

MNIACEAE

Mnium affine Bland.—Warren Co.: in woodlands, near Kinzua, *17212*, det. Steere, *17213*, det. Steere; on and near prostrate decayed logs in moist woods, Deerlick road, near Sheffield, *17263*, det. Steere; on and near mossy logs and banks in woods, often associated with *M. punctatum* var. *elatum*, Cranbrook Farm, North Warren, *17298*, det. Steere, *17300*, det. Steere, *17302*, det. Steere, *17303*, det. Steere; among dead leaves on moist bank in woods, near Sheffield, *18184*, det. Steere.

Mnium cuspidatum (L.) Leyss.—Warren Co.: on prostrate logs in moist woods, Deerlick road, near Sheffield, *17252*, det. Steere,[14] *17256*, det. Steere.[14]

Mnium punctatum L.—Warren Co.: on and near mossy logs in woods, Cranbrook Farm, North Warren, *17301*, det. as "*M. punctatum* Hedw." by Steere.

Mnium punctatum var. *elatum* Schimp.—Warren Co.: associated with *M. affine* on and near mossy logs in woods, Cranbrook Farm, North Warren, *17298a*, det. Steere; in moist pine woods along Four Mile Creek, *18067*, det. Steere.

AULACOMNIACEAE

Aulacomnium palustre (Hedw.) Schwaegr.—Warren Co.: on and near prostrate decayed logs in moist woods, Deerlick road, near Sheffield, *17272*, det. Steere; along woodland brooks, Cranbrook Farm, North Warren, *17314*, det. Steere.

BARTRAMIACEAE

Bartramia pomiformis (L.) Hedw.—Warren Co.: along woodland brooks, Cranbrook Farm, North Warren, *17310*, det. as "*B. pomiformis* Hedw." by Steere.

Philonotis fontana (L.) Brid.—Warren Co.: on prostrate logs in moist woods, Deerlick road, near Sheffield, *17250*, det. as "*P. fontana* (Hedw.) Brid." by Steere.

THUIDIACEAE

Thuidium delicatulum (L.) Mitt.—Warren Co.: along woodland brooks, Cranbrook Farm, North Warren, *17317*, det. Steere;[15] among dead leaves on moist bank in woods, near Sheffield, *18186*, det. Steere.[15]

AMBLYSTEGIACEAE

Amblystegium varium (Hedw.) Lindb.—Warren Co.: on prostrate logs in moist woods, Deerlick road, near Sheffield, *17259*, det. Steere.

Drepanocladus aduncus (Hedw.) Warnst.—Warren Co.: on and near logs along woodland brooks, Cranbrook Farm, North Warren, *17321*, det. Steere.

HYPNACEAE

Brotherella recurvans (Michx.) Fleisch.—Warren Co.: on logs along woodland brooks, Cranbrook Farm, North Warren, *17322*, det. Steere; among needles on floor of pine woods, Four Mile Creek, *18064*, det. Steere; among dead leaves on moist bank in woods, near Sheffield, *18185*, det. Steere.

Heterophyllium haldanianum (Grev.) Kindb.—Warren Co.: on prostrate logs in moist woods, Deerlick road, near Sheffield, *17257*, det. Steere; along woodland brooks, Cranbrook Farm, North Warren, *17318*, det. Steere; among dead leaves on moist bank in woods, near Sheffield, *18180*, det. Steere.

Hypnum curvifolium Hedw.—Warren Co.: along woodland brooks, Cranbrook Farm, North Warren, *17309*, det. Steere.

Hypnum sp.—Warren Co.: associated with *Dicranum* on prostrate logs in woods, Deerlick road, near Sheffield, *17255*, det. Steere.

Ptilium crista-castrensis (L.) De Not.—Warren Co.: among needles in pine woods

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14 As "*M. cuspidatum* Hedw."

15 As "*T. delicatulum* (Hedw.) Mitt."

along Four Mile Creek, *18060*, det. as "*P. crista-castrensis* (Hedw.) De Not." by Steere.

PLAGIOTHECIACEAE

Plagiothecium denticulatum (L.) B. S. G.—Warren Co.: on prostrate logs in moist woods and forming overlapping shelves on dirt bank along stream, Deerlick road, near Sheffield, *17253*, det. Steere,[16] *17258*, det. Steere.[16]

Plagiothecium deplanatum (Sull.) Grout—Warren Co.: along woodland brooks, Cranbrook Farm, North Warren, *17308*, det. Steere, *17316*, det. Steere.

BRACHYTHECIACEAE

Bryhnia novae-angliae (Sull. & Lesq.) Grout—Warren Co.: colony on mossy log between North Warren and Russell, *17241*, det. Steere; on and near logs along woodland brooks, Cranbrook Farm, North Warren, *17319*, det. Steere.

Eurhynchium serrulatum (Hedw.) Kindb.—Warren Co.: on and near mossy logs in woods, Cranbrook Farm, North Warren, *17299*, det. Steere.

CLIMACIACEAE

Climacium americanum Brid.—Warren Co.: among needles in pine woods, along Four Mile Creek, *18062*, det. Steere.

POLYTRICHACEAE

Atrichum undulatum (L.) P. Beauv.—Warren Co.: in woodlands, near Kinzua, *17211*, det. Steere;[17] along woodland brooks, Cranbrook Farm, North Warren, *17312*, det. Steere,[17] *17313*, det. Steere.[17]

Pogonatum pensilvanicum (Hedw.) Paris—Warren Co.: on clay banks, near Sheffield, *18188*, det. Steere.

Polytrichum juniperinum Willd.—Warren Co.: among lichens on boulders and in damp woods between Sheffield and Brookston, *18128*, det. Steere,[18] *18141*, det. Steere.[18]

Polytrichum ohioense R. & C.—Warren Co.: on mossy banks in woods and along woodland brooks, Cranbrook Farm, North Warren, *17305*, det. Steere, *17311*, det. Steere.

GEORGIACEAE

Tetraphis pellucida Hedw.—Warren Co.: on logs along woodland brooks, Cranbrook Farm, North Warren, *17320*, det. Steere; among dead leaves on moist bank in woods, near Sheffield, *18183*, det. Steere, *18187*, det Steere.

RANUNCULACEAE

Eranthis hyemalis Salisb.—Warren Co.: in outdoor cultivation, North Warren, *16201*, det. Bailey.

CARDUACEAE

Aster lamarckianus Nees—Warren Co.: in meadows, near Sheffield, *18215*, det. as "*A. paniculatus* Lam." by Blake.

Aster lateriflorus (L.) N. L. Britton—Warren Co.: in meadows, North Warren, *17985*, det. Blake.

Aster prenanthoides Muhl.—Warren Co.: in roadside ditches, near Brookston, *18005*, verif. Blake, who says "very deeply toothed leaves"; in moist meadows and fields, Willow Street Run, Sheffield, *18118*, verif. Blake, *18121*, det. Blake, who says "has very narrow leaves and may be of hybrid origin," *18122*, verif. Blake, who says "about normal," *18123*, verif. Blake.

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16 As "*P. denticulatum* (Hedw.) B.S.G."
17 As "*A. undulatum* (Hedw.) Beauv."
18 As "*P. juniperinum* Hedw."

Chrysanthemum coronarium L.—Warren Co.: in outdoor cultivation, North Warren, *16454*, det. Bailey.

CUSCUTACEAE

Cuscuta campestris Yuncker—Warren Co.: parasitic on *Xanthoxalis*, *Ambrosia*, and *Trifolium* in fields, North Warren, *18226*, det. Yuncker.

LAMIACEAE

Clinopodium vulgare L.—Warren Co.: in grassy fields, between Irvington and Tideoute, *17506*.

CYPERACEAE

Scirpus atrovirens Muhl.—Warren Co.: in meadows, near Brookston, *18016*, det. Core; in marshes along Four Mile Creek, *18033*, det. Core.

Scirpus polyphyllus Vahl—Warren Co.: in marshes, between Sheffield and Brookston, *18127*, det. Core.

Unidentified cryptogams—Warren Co.: *14859*, *15509*, *15612*, *15748*, *15753*, *15754*, *15872*, *15873*, *15877*, *15878*, *15982*, *15993*, *16437*, *16439*, *16514*, *16591*, *16680*, *16681*, *16732*, *17181*, *17794*, *17795*, *18181*, *18182*, Flanagan[19] *3*, *4*, *5*, *6*, *7*, *10*, *11*, *12*, *13*, *20*, *21*, *22*, *23*, in part, *25*, *28*, *29*, *31*, in part, *32*, *33*, *34*, in part, *36*, in part, *39*, *40*, *43*, in part, *45*, *52*, *53*, *54*, *55*, in part, *57*, *62*, *64*, *68*, in part, *74*, *76*, *77*, *85*, *86*, *87*, *88*, *89*, *91*, in part, *94*, *96*, *99*, *104*, *105*, *106*, in part, *107*, *108*, in part, *110*, *113*, *115*, in part, *116*, in part, *117*, *118*, in part, *123*, *126*, in part, *127*, in part, *133*, *135*, *136*, *137*, *138*, in part.

Unidentified phanerogams—Warren Co.: *17974*, *17975*.

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19 All the numbers following in this paragraph are Flanagan collection numbers.

N. Y. BOTANICAL GARDEN,
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A Taxonomic and Cytological Study of the Genus Wyethia, Family Compositae, With Notes on the Related Genus Balsamorhiza[1]

William A. Weber[2]

Secondary intergradation between taxonomic species of *Balsamorhiza* and *Wyethia* has been discovered and reported by Rogers (1942), Maguire (1942), and Ownbey and Weber (1943). Following superficial field studies of the putatively hybrid swarms, a combined cytological analysis and breeding program was begun in the fall of 1942, with the aim of studying the biology of speciation in these genera. An understanding of the specific units and range of variation in *Balsamorhiza* was made possible by the availability of a monographic study by Sharp (1935). A similar study of *Wyethia* was undertaken as a prerequisite for biological studies in the latter group. The result of the taxonomic study, plus cytological data thus far accumulated, is the subject of the present paper.

History

The genus *Wyethia* was described by Thomas Nuttall (1834) in an enumeration of the plants collected by the first Wyeth Expedition, 1832-33. In placing it in the tribe Heliantheae, he distinguished this group from all other helianthoid genera by the presence of pistillate, fertile ray-flowers and a coroniform, awned pappus. Since the original publication of *Wyethia*, two additional generic names have been used for its members. These are *Alarçonia* and *Melarhiza* which were proposed by de Candolle (1836) and Kellogg (1873), respectively, who were apparently unaware of the existence of the earlier name.

The first comprehensive synopsis of the genus *Wyethia* was published by Gray (1873), at a time when nine species were known, and, despite the inadequacy of the material at hand, Gray's treatment remains essentially sound. Since the paper by Gray, seven additional species have been proposed, one of which, *W. mexicana* Watson, has recently been segregated as the monotypic genus *Vigethia* (Weber, 1943).

Among the recent treatments, that of Jepson (1925) is most inclusive, treating eight species and three varieties. Kearney and Peebles (1942) list the two species occurring in Arizona, and Peck (1941) the four occurring in Oregon.

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1 An investigation carried out in the Herbarium and Department of Botany of the State College of Washington and submitted as a thesis in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

2 Formerly Graduate Fellow in Botany, and Assistant Curator of the Herbarium, State College of Washington, 1943-44.

In the present revision, the genus is divided into three sections, and a total of 14 species and two varieties (geographic races or subspecies) are recognized. The sectional alliances in the genus *Wyethia*, in the order in which they are treated, are as follows:

Section I. Agnorhiza

1. *W. ovata*
2. *W. Bolanderi*
3. *W. reticulata*
4. *W. elata*
5. *W. invenusta*
6. *W. scabra* and varieties

Section II. Alarçonia

7. *W. glabra*
8. *W. helenioides*

Section III. Euwyethia

9. *W. mollis*
10. *W. helianthoides*
11. *W. angustifolia*
12. *W. longicaulis*
13. *W. amplexicaulis*
14. *W. arizonica*

Morphology

Roots.—The root system is imperfectly known except in some species of the section Euwyethia. Here it is somewhat similar to that of *Balsamorhiza*, section Artorhiza. The roots are very large, deep, fusiform as in that group, but with a smooth bark covered for most of its length with small rootlets. The crown of the root is buried a few inches below the ground and bears at its apex a few short erect underground stems.

Stems.—Sharp (1935) stated that according to stelar evidence the crown of the tap-root may be designated as stem. Thus, in these genera the stems are of two kinds, the first underground and perennial, the second aerial and annual. In *W. amplexicaulis* and *W. helianthoides*, the only species available for study in the live state, the aerial stem arises from the apex of the subterranean stem and always bears several cauline leaves. Additional enlarged basal leaves are present in these species, but they may be present or absent in the others.

There are several interesting adaptational features of the aerial stems of *W. amplexicaulis*. The entire shoot, including the leaves and partially-differentiated inflorescence, is present during the dormant period in the form of a terminal bud covered by numerous thick scales, just as in many deciduous shrubs. During the act of elongation, the shoot of the current year is usually prostrate on the ground. As soon as the terminal head of the inflorescence is well differentiated the entire stem becomes erect from a point near the base of the stem. Herbarium specimens frequently display striking evidence of this last phenomenon, for in the great majority the stems are strongly curved at the base. This is not a generic characteristic, however, for in *W. reticulata*, according to observations by G. T. Robbins (correspondence), the plants are erect from their first appearance to the time they bloom, and the flower buds evidently appear after the stem has elongated.

At maturity the stems are conspicuously longitudinally striate, usually unbranched, with a terminal head, and sometimes several additional ones from the axils of only slightly reduced upper leaves.

Leaves.—The leaves are always alternate. Two main types of leaf outline prevail. In the sections Euwyethia and Alarçonia the leaves are predominantly lanceolate, pinnately veined and narrowed to the base and apex. In Agnorhiza they are broadly ovate or deltoid, with the exception of *Wyethia scabra,* where the leaves are lance-linear. In this section two of the lowermost lateral nerves are enlarged and more conspicuous than the rest, giving the effect of palmate venation. In *W. scabra* the lateral nerves are confluent near the margin, giving rise by anastomoses to two submarginal nerves.

The leaf margins are usually entire, but occasionally are irregularly denticulate, dentate, or serrate, and sometimes are rather regularly crenate-serrate in some species of Agnorhiza. The texture is often leathery, particularly in age, when the coriaceous texture is usually associated with the accentuation of the veins and loss of indument. When basal leaves are present, the cauline leaves are gradually reduced upward. In those species which lack large basal leaves, the cauline leaves are largest near the middle of the stem, becoming reduced upward and downward. No marked reduction in size is found in the leaves of the inflorescence. The shape, relative number of leaves, and their position on the plant, furnish valuable taxonomic characters.

Indument.—The nature and amount of pubescence is of great value in distinguishing the species. *Wyethia amplexicaulis* is entirely glabrous. Other species are pilose, hirsute, villous, or hispid. Frequently the hairs are interspersed with dark, sessile or short-stipitate glands. Each species has a very characteristic type of pubescence which usually is sufficient to distinguish an entity, even in the seedling stage. The stems, leaves, and inflorescences are often covered by a balsam-odored resinous varnish.

Inflorescence.—The inflorescence consists of medium-sized or very large terminal or axillary heads. The number of heads and the relative length of their peduncles often have taxonomic use.

Involucre.—Phyllaries in *Wyethia* fall into three morphological types. The first is lanceolate in outline, slightly dilated at the tip, equalling or only slightly exceeding the disk. This is the type characteristic of the section Euwyethia. The second type, tapering from base to apex, attenuate not dilated above, equaling the disk, is found in the races of *W. scabra.* The third type, characteristic of the section Alarçonia, is foliaceous, ovate, and usually greatly exceeds the disk. The section Agnorhiza exhibits all three types.

The pubescence of the phyllaries and, to some extent, of the pales, floral parts and achenes, parallels that of the foliage and is of no additional importance as a taxonomic character.

Receptacle and Pales.—The receptacle is flat or broadly convex. The

pales are lanceolate, acute, conduplicate, becoming stiff and persistent after the fall of the achenes.

The heads are either hemispherical or campanulate in shape, correlating with the width of the receptacle and the number of disk florets. In some species both types are found on the same plant. *Wyethia amplexicaulis*, for example, has a very large, terminal head which is hemispherical in shape, and smaller, lateral heads which are often campanulate.

In the following systematic treatment, all measurements of heads are exclusive of the ray-flowers.

Corollas.—The heads are heterogamous with styliferous, fertile ray-flowers and perfect, fertile, tubular disk-flowers. The corollas of both the ray- and disk-flowers are yellow, except in *Wyethia helianthoides* where the ray-flowers are cream-colored or white. The ray-flowers usually contain one or more staminodia. The disk-flowers have a narrow cylindrical tube which expands above into the tubular-campanulate 5-lobed limb.

The anthers have ovate appendages and are sagittate at the base. The style branches are slender, terete, and more or less hirsutulous from base to apex.

Median bundle traces are well developed in the corollas of the species of the section Alarçonia. In the other species these are almost always absent.

Achenes.—The achenes are quadrangular in the disk; slightly dorsally compressed in the ray-flowers. The pappus, when present, consists of a ring of laciniate scales on the periphery of the apical end of the achene. It is always persistent, and may or may not be prolonged on the angles into one or more filiform or stout bristles or awns.

As originally defined, the genus *Wyethia* included only species with pappose achenes. The closely related *Balsamorhiza* included only epappose members. It is believed that the selection of a single character as the pappus for generic separation has, in this instance, caused close relatives to be placed in different genera.

Two species formerly included in *Balsamorhiza* on the basis of the naked achenes are herein formally transferred to *Wyethia*. These entities, *Wyethia Bolanderi* and *W. invenusta*, share but a single morphological characteristic with *Balsamorhiza*, namely, the epappose achene. In all other respects they resemble the species of *Wyethia*, section Agnorhiza. The leaves are cauline, triangular-ovate with three prominent nerves; basal leaves are absent; and the distributional area (see map 2) is continuous with the other species in that group. Without these two anomalous species, *Balsamorhiza* is a well-defined natural group consisting solely of scapose perennial herbs with either sagittate leaves (section Artorhiza) or variously-toothed or lobed leaves (section Eubalsamorhiza) and epappose achenes.

Seedlings.—The seedlings of 10 species of *Wyethia* and *Balsamorhiza* were examined and were found to be very similar. The first year's growth consists of the two cotyledons and a single erect, lanceolate leaf, two or three centimeters in length. The cotyledons of *Wyethia* are oblanceolate, much longer than broad, while those of *Balsamorhiza* are elliptic or oval, not more than twice as long as broad. An interesting feature of both genera is the presence of a prominent cotyledonary tube. The leaves assume the texture and pubescence characteristic of the species at a very early age. Plants three years old in the experimental garden have not yet flowered.

Cytology

The chromosome number of nine species of *Wyethia* and *Balsamorhiza* has been determined. In each species studied the number was found to be n=19, 2n=38. Bivalents of *Wyethia amplexicaulis* (fig. 5) and *W. helenioides* (fig. 2) were of the cruciform type.

Root tips were prepared in a Navaschin fixative (10-4-1) and stained with crystal violet. Microsporocytes were studied by the temporary aceto-carmine smear technique.

A tabular arrangement of the data follows:

Species	n	2n	Source
Balsamorhiza Careyana (Fig. 1)	—	38	16 mi. s. of Lind, Adams Co., Wash., *S. P. Swenson & E. G. Schafer.*
B. incana (Fig. 4)	—	38	3 mi. n. of Anatone, Asotin Co., Wash., *M. Ownbey 2541.*
B. rosea	19	—	Summit of hills s. w. of Touchet. Walla Walla Co., Wash., *W. A. Weber 2621.*
B. sagittata	19	—	Pullman, Whitman Co., Wash., *W. A. Weber.*
B. serrata	19	—	Summit of grade between Dodge and Chard, Garfield Co., Wash., *W. A. Weber.*
Wyethia amplexicaulis (Fig. 5)	19	38	Pullman, Whitman Co., Wash., *W. A. Weber.*
W. angustifolia	—	38	Skyline Drive at Round Top. Oakland Hills, Berkeley, Calif., *G. L. Stebbins, Jr.*
W. helenioides (Fig. 2)	19	—	Tilden Park, Berkeley, Calif., *G. L. Stebbins, Jr.*
W. mollis (Fig. 3)	—	38	Richardson's resort, s. w. side of Lake Tahoe. Eldorado Co., Calif., *G. L. Stebbins, Jr.*

Wherever possible, herbarium specimens from colonies which provided counts have been deposited in the collections of the State College of Washington. In some instances where seed alone was available, plants grown from the same collection of seed have been placed in the experimental garden, and a permanent record of them will be made at a future date.

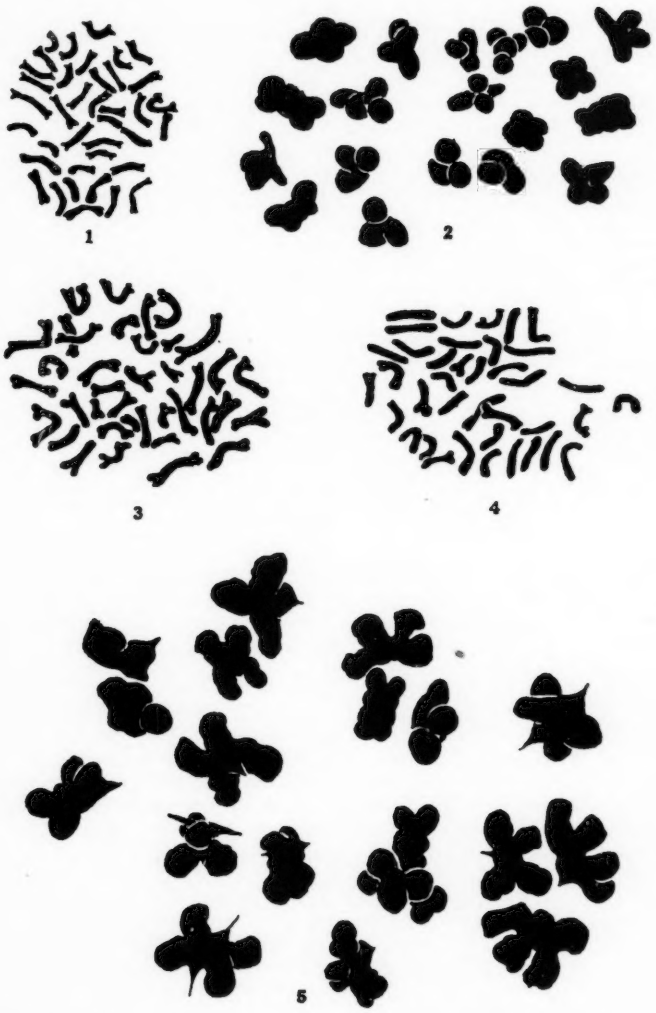


Fig. 1. *Balsamorhiza Careyana*. Metaphase, mitotic division in root tip cell. Fig. 2. *Wyethia helenioides*. Metaphase I, meiotic division of microsporocyte. Fig. 3. *Wyethia mollis*. Metaphase, mitotic division in root tip cell. Fig. 4. *Balsamorhiza incana*. Metaphase, mitotic division in root tip cell. Fig. 5. *Wyethia amplexicaulis*. Metaphase I, meiotic division of microsporocyte. (All × 2700).

Phylogeny

According to traditional phylogenetic concepts, the genus *Wyethia* contains species which possess characteristics indicative of great age. Stebbins (unpublished) believes the section Alarçonia to be one of the most ancient of living groups of Compositae, for the following reasons:

> The inflorescence of these species, consisting of a few heads on stout peduncles coming from the axils of leaves rather than bracts represents the most primitive type of inflorescence in any group. The involucral bracts are more leaf-like, and pass more gradually into the upper cauline leaves, than in any other composite. Also the receptacular paleae are more bract-like than in any other composite, and there is great similarity between inner involucral bracts and the outer row of receptacular paleae. This may all be summed up by saying that the transition from the lowermost to the uppermost of the subtending foliar organs is more gradual, and the serial homology between them is more evident in these *Wyethia* species than in any other members of the family known to me.
>
> Next, *Wyethia* is one of the very few genera of the primitive tribe Heliantheae in which all of the florets are fertile and in which all of the floral parts: namely, calyx, corolla, stamens and gynoecium, are present in all of the disk florets. Next, the ovary is large at flowering time as well as in the achene, and is not modified by flattening. Furthermore, the ovary cavity at anthesis is relatively large, so that the ovule is far from filling it, and in *W. helenioides* I have not infrequently found two ovules per ovary. Then, the pappus is more calyx-like than in any other composite known to me.
>
> Finally, the vascular anatomy of the florets is complex and highly developed. The midvein of the corolla-lobe is present, as well as the fused laterals; the lateral bundles of the style are sometimes present, as in species of *Dubyaea*.
>
> These points tie in with the distributional pattern . . . to give a general picture of primitiveness that is approached only by a few genera of Mutiseae, which have an obviously specialized setose pappus and lack receptacular paleae; perhaps in some Vernoniae; and in the primitive Cichoriae . . . which are in several respects more advanced than *Wyethia*.

Stebbins (1939) also noted a strong similarity between *Palaeanthus problematicus*, a fossil composite from the Upper Cretaceous Amboy Clay of New Jersey and present-day members of the genus *Wyethia*. The record of this species consists of several heads from which the ray-flowers and phyllaries have fallen, leaving the receptacle and pales. *Palaeanthus* resembles *Wyethia* in having a broadly convex receptacle and persistent, lance-linear, acute, conduplicate pales.

Anderson (1934) has advanced the speculation that the Magnoliales (x=19) may have arisen reticulately from simpler members of the Coniferales (x=12) and the Gnetales (x=7). The chromosome number 19 is one of the rarest in the plant kingdom, having been observed, up until the present time, only in the Magnoliales (Whitaker, 1933), Salicales (Blackburn and Harrison, 1924), and now in the composites *Wyethia* and *Balsamorhiza*.[3] The first two groups, from their morphology, geographic distribution, and geologic history may be regarded as primitive angiosperms. It may be significant that the same chromosome number is found in some of

[3] Also in *Dracaena*, family Liliaceae (Bowden, 1945).

the most primitive of the living composites, a possible prototype of which occurred along with the dominant Magnoliales, Salicales, and Coniferales as early as the Upper Cretaceous.

Generic Relationship

Wyethia is placed in the tribe Heliantheae. It is distinguished from all other genera of the tribe by a combination of the following attributes: perennial herbaceous habit; pistillate, fertile ray-flowers; alternate cauline leaves; and usually a persistent coroniform pappus.

Cytologically and morphologically *Wyethia* is more closely akin to *Balsamorhiza* than to any other existing genus, differing only in the leafy-stemmed habit. In fact, if the data now at hand had been available at the time of the original definition of the genera, it is quite possible that the two would have been regarded as a single genus with two very well-marked subgenera. The presence of connecting links between the pappose and epappose condition in *B. sagittata* (Sharp, 1935) and *B. macrophylla* would support such an interpretation, and the similar karyotype would be additional confirming evidence.

Distribution

The genus *Wyethia* is confined to western North America, reaching its greatest development as to number of species in the State of California. Members of the genus are distributed from eastern Wyoming south to Colorado, Arizona, and New Mexico and west to the Pacific Coast States and northern Lower California.

The species have a wide variety of habitat preferences. They are found from sea level to over 2,500 meters altitude. For the most part they require soil which is quite moist for at least a portion of the growing season.

The three sections of the genus have very distinct patterns of distribution. The section Alarçonia is limited to the San Francisco Bay region of California, north to Mendocino County and south to San Luis Obispo County, west to the Sierra Nevada foothills. The section Agnorhiza, a group in which narrow endemism is the rule, has most of the species confined to the Sierra Nevada of central California. The section Euwyethia, containing the more aggressive species (*W. amplexicaulis* having the broadest distribution), includes and overlaps the geographic areas of the other sections, and roughly follows the generic distribution outlined above.

Specific Concept

The species in this treatment are biological units, that is, populations which are geographically or ecologically discrete, are morphologically distinguishable at all times, and are effectively isolated from all other such populations by one or more barriers. The most obvious barriers to genic contamination are the strong ecologic preferences and actual physical

separation by distance or by geographic barriers. In addition, two species occurring in the same area are usually effectively separated by a difference in the time of flowering. In a number of cases, nevertheless, it appears that the development of genetic isolating mechanisms has not kept pace with other types of barrier formation.

Natural Hybridization

During the course of this work putatively hybrid individuals have been noted involving the following species: *Wyethia amplexicaulis* x *W. arizonica; W. amplexicaulis* x *W. helianthoides; W. angustifolia* x *W. glabra; W. angustifolia* x *W. helenioides; W. angustifolia* x *W. longicaulis;* and *W. angustifolia* x *W. mollis.* The evidence for hybridization in most instances rests upon herbarium specimens which display characteristics of two species in combinations which under experimental conditions would be attributed to hybridity. Many of these were collected by competent botanists who knew

Fig. 6. Diagram showing apparent relationships between the species of the genus *Wyethia* based on the occurrence or absence of putative hybrids between them.

the species involved and either suspected interspecific hybridization or were puzzled by the unusual variation in species which ordinarily were not strikingly variable. This variation is unusual because it is in the direction of a second species which grows in the same vicinity, rather than the extreme of divergence from the norm of the species.

The case for natural hybridization between *Wyethia amplexicaulis* and *W. helianthoides* has been given particular attention. As early as 1912, the late W. C. Cusick collected an extensive series including both species and

intermediate forms in Hog Valley, Union Co., Oregon, and sent them to Piper for determination. While recording his suspicions of their hybrid origin, Piper gave the intermediates taxonomic recognition as *W. Cusickii.* Maguire (1942) reported approximately 15 per cent of the individuals in mixed colonies of these two species occurring in Idaho to show intermediacy in the essential morphological characters and presumed them to be hybrids. In localities where only one species occurred, no intermediates were found. His observations led him to believe that the hybrids were fertile and were able to cross back to either parent.

In 1942, Marion Ownbey (unpublished) studied these species 10 miles north of Enterprise, Wallowa Co., Oregon. They were growing in adjacent colonies, *W. helianthoides,* just past flower, on a low meadow near a creek and *W. amplexicaulis,* in full bloom, on slightly higher, better-drained ground. Late-flowering plants of *W. helianthoides,* blossoming simultaneously with early-flowering plants of *W. amplexicaulis,* apparently crossed and produced a number of morphologically and seasonally intermediate individuals along the zone of contact between the two species.

In 1945, the author examined many colonies in the Blue and Ochoco mountains of eastern and central Oregon. In this region *W. helianthoides* covers many thousands of acres of mountain meadows at medium altitudes. *W. amplexicaulis* grows on well-drained sites, in open woods or forest-meadow fringes, and drier meadows. Intermediate individuals were found only where the two species came into close contact. In every instance this contact occurred on areas which had been disturbed by heavy grazing.

The first colony studied was below Crystal Spring, Sec. 6, T. 13 S., R. 20 E., Ochoco National Forest, Wheeler County. Several small colonies of *W. helianthoides* grew in the wet meadow along Crystal Creek. The species was beginning to set seed, and only a few flowering individuals remained. *W. amplexicaulis,* in full bloom at that time, grew in scattered patches or individually in the open pine woods. A few plants were present on the fringe of the forest and on the drier parts of the meadow itself. In these transition areas, where the two species came into close contact, a few intermediate individuals were discovered.

A second colony was observed at Ross Lava, Sec. 20, T. 13 S., R. 22 E., Ochoco National Forest, Crook County. The area is a heavily overgrazed and depleted ridgetop which supports a more or less mixed colony of the two species on the sites which have retained a little soil. *W. amplexicaulis* has invaded the area from a nearby patch of woodland and intermediate individuals are found in abundance throughout the colony of *W. helianthoides.*

Other mixed colonies containing intermediate individuals were found at the following localities: Squaw Meadows, Sec. 14, T. 14 S., R. 24 E., Ochoco National Forest, Wheeler County; near Allison Ranger Station, Sec. 15, T. 19 S., R. 26 E., Ochoco National Forest, Harney County; Clark Meadows, Sec. 22, T. 11 S., R. 31 E., Grant County; on south side of Pendleton-John Day Highway, Sec. 32, T. 11 S., R. 30 E., Grant County.

The morphological discontinuity between *W. amplexicaulis* and *W. helianthoides* is abrupt and absolute. It is only when the two grow together that intermediates occur. The specific attributes of the two entities are presented in the following table:

	W. amplexicaulis	*W. helianthoides*
Ray flowers:	Lemon-yellow	Pure white or creamy-white
Indument:	Totally glabrous	Densely hirsute
Heads:	Several	Solitary
Phyllaries:	Few, ovate-lanceolate, tightly imbricate	Very numerous, linear, very loose
Foliage:	Dark green, lustrous, cauline leaves sessile	Light gray-green, dull, cauline leaves petiolate

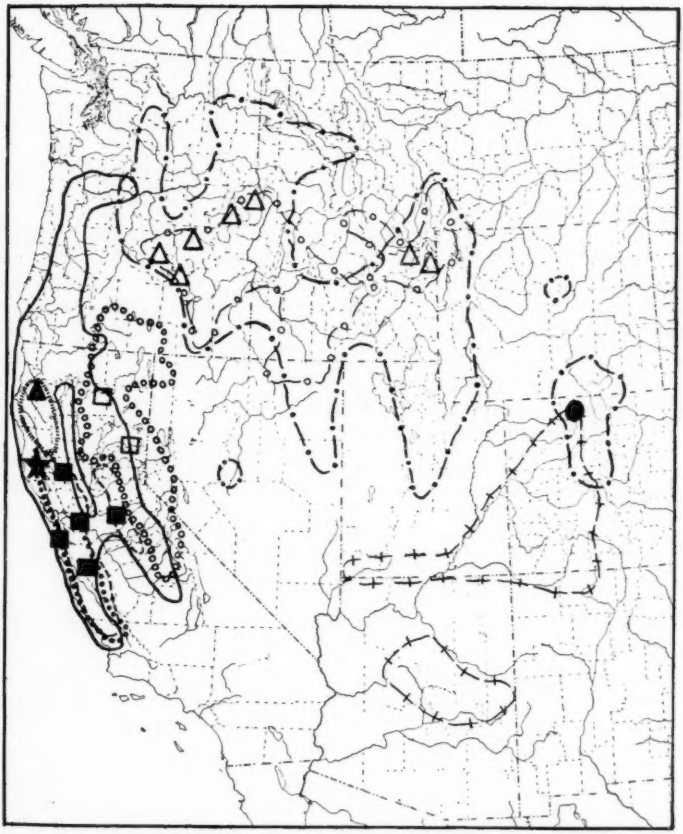
Intermediate individuals possess the general aspect of *W. amplexicaulis*. The ray-flowers range in color from the deep yellow characteristic of *W. amplexicaulis* through several intermediate shades of yellow to cream-color. Every putative hybrid examined has exhibited some pubescence; many are almost as densely hirsute as typical *W. helianthoides*. The heads vary in number. The phyllaries display a considerable range of shape and size, even on the same head. The foliage also varies, but there is a tendency to retain the shape and size of the leaves of *W. amplexicaulis* while acquiring the pubescence of *W. helianthoides*.

In none of the localities studied did the putative hybrids comprise as much as 15 per cent of the mixed populations. At the Crystal Spring station the absence of any juvenile intermediates in the vicinity, the rarity and uniformity of the mature intermediate individuals suggests that the latter were first generation offspring of the original cross and that conditions there are not favorable for continued crossing.

The suspected F_1 plants were especially noteworthy for their apparent hybrid vigor. They invariably were larger and more robust than either parent. In general the plants resembled *W. amplexicaulis* except for the pubescent herbage, the cream-colored rays and the intermediate characteristics of the phyllaries and leaves. The plants were a little past full bloom.

At the Ross Lava station the situation was quite different. Here the colony took on the aspect of a hybrid swarm, with almost every conceivable variation and combination of the parental characters. The site occupied by *W. helianthoides* was drier than usual, and the hybrids had successfully invaded the colony of that species.

At its extreme southeastern periphery, the range of *W. amplexicaulis* overlaps that of a third species, *W. arizonica*. Here at Elk River, Routt County, Colorado, intermediates have been collected (*Goodding 1664*). As in the *W. amplexicaulis* x *W. helianthoides* cross, the intermediates retain the general aspect and foliage of *W. amplexicaulis*, but display the harsh pubescence of *W. arizonica*. Evidently the specimens were recognized as exhibiting noteworthy departures from the normal range of variation of either



Map 1. Approximate distribution of species of *Wyethia*, sections Alarçonia and Euwyethia, showing occurrence of putative hybrids: dots and dashes, *W. amplexicaulis*; solid line, *W. angustifolia*; plus signs, *W. arizonica*; dots, *W. glabra*; dashes, *W. helenioides*; circles and dashes, *W. helianthoides*; parallel lines, *W. longicaulis*; circles, *W. mollis*. Putative hybrids: solid disk, *W. amplexicaulis* x *W. arizonica*; open triangles, *W. amplexicaulis* x *W. helianthoides*; star, *W. angustifolia* x *W. glabra*; solid squares, *W. angustifolia* x *W. helenioides*; solid triangle, *W. angustifolia* x *W. longicaulis*; open squares, *W. angustifolia* x *W. mollis*.

species, for the herbarium labels bear an unpublished manuscript name. It was not until the entire collection was reassembled from five herbaria that the probability of hybrid origin became apparent.

Next to *W. amplexicaulis*, the species most important in the consideration of natural hybridization is *W. angustifolia*. This species occupies an area second in size only to that of *W. amplexicaulis*, and overlaps the ranges of the two remaining species of Euwyethia, and both species of Alarçonia. Intermediates have been observed between *W. angustifolia* and each of these.

Specimens connecting *W. angustifolia* with *W. mollis* have been collected at Fall River Mills, Shasta County, California (*Eastwood and Howell 7927*); 12 miles east of Belden, Plumas County, California (*Rose 39261*); and at several other localities where these species come into contact. The evidence for hybridization between *W. angustifolia* and *W. longicaulis* rests upon a single intermediate specimen collected with *W. angustifolia* at Covelo, Mendocino County, California (*Eastwood 15201 in part*). Both species are represented in other collections from Round Valley, in which Covelo is situated. As in the *W. amplexicaulis* x *W. helianthoides* crosses the characteristics of the more aggressive and widepread species (*W. angustifolia*) dominate the general aspect of the hybrids in both of these crosses, while the characteristics of the other species express themselves in the intermediate nature of the indument, and the shape and size of phyllaries and leaves.

Intermediate individuals connecting *Wyethia angustifolia* with the two species of section Alarçonia, *W. glabra* and *W. helenioides* traverse sectional lines and thus deserve special consideration. From a morphological viewpoint *W. angustifolia* is not a close relative of either species, but under certain conditions it seems to produce fertile hybrids with both *W. glabra* and *W. helenioides*. The series studied exhibit many combinations of the parental characters, indicating that backcrosses probably take place.

Wyethia helenioides is distinguished from *W. glabra* morphologically by the presence of a copious tomentum on all parts of the plant. Although the geographic distributions of the two are more or less coincident, the species are effectively isolated from each other, according to Stebbins (correspondence), by sharp differences in habitat. *W. helenioides* is found only on open, sunny slopes, while *W. glabra* usually grows in shade. At maturity *W. helenoides* loses much of its characteristic pubescence and then is frequently confused with *W. glabra*, but intermediates suggesting either primary or secondary intergradation are unknown. There are evidently very effective barriers separating these species, the obvious one being ecologic.

Notwithstanding the effectiveness of the barriers directly separating them, *W. glabra* and *W. helenioides* seem potentially able to exchange genes through the medium of *W. angustifolia*. A convincing series of herbarium specimens connecting *W. angustifolia* with *W. glabra* has been collected by Jepson at Pieta, Mendocino County, California (*Jepson 20832, 20833, 20834*); an equally excellent series connecting *W. angustifolia* and *W. helenioides*, by

Howell near St. Mary's College, Contra Costa County, California (*Howell 11286, 11287, 11288*); and additional intermediates at several localities, by other collectors.

In the sections Euwyethia and Alarçonia of the genus *Wyethia*, morphological divergence and ecological isolation appear to be developed to a high degree without the consequent formation of genetic barriers. Thus interspecific (and even intersectional) crosses take place when existing barriers are bridged. This phenomenon has been discussed in detail by Huxley (1942, p. 146 *et seq.*), who suggests that the formation of hybrid swarms in plant species has been stimulated in recent times by increased opportunities for crossing, due to "changed ecological conditions caused by man's interference." Leveling, in this manner, of the ecological gradient separating niches occupied by different species may be one explanation of the large number of hybrids observed in *Wyethia* and *Balsamorhiza*. It is possible that the situation has arisen since the coming of the white man and his utilization of the western range lands on a large scale for grazing purposes.

In contrast, the isolating mechanisms separating the six species of the section Agnorhiza appear to be 100 per cent effective. No intermediates are known which connect these species with each other or with any other species in the genus. With two exceptions (*W. ovata* and *W. scabra*) these species are greatly restricted in the geographical areas and ecological niches which they occupy, and are depleted of biotypes.

Economic Importance

Certain of the species, notably *W. amplexicaulis* and *W. helianthoides*, are rather highly valued as range forage plants. During the growing season livestock seem to be particularly fond of the flower heads, and occasionally crop the more tender leaves. In the late summer of 1945, the author observed complete utilization by sheep of *W. amplexicaulis* on range in eastern Oregon after the plants had cured.

A note on the label accompanying *Palmer 256* (*W. ovata*), states that in the vicinity of San Diego this species is commonly known as "ragweed" and that cows which graze it produce milk which is bitter and useless.

Roots and seeds of *Wyethia* and *Balsamorhiza* were a source of food and medicine for the American Indian. Nuttall (1834) reported that "the root of [*Wyethia amplexicaulis*], after heat and fermentation, by which process it becomes somewhat saccharine, is then eaten by the natives." Coville (1897) records the use of *W. mollis* in medicine, stating, "the roots of a plant, which from the description is probably this, are mashed and used as a poultice for swellings." *W. scabra* is said to have uses as an emetic by the Hopi and Navajo, but it is considered dangerous (Kearney and Peebles, 1942). This use is also mentioned with reference to the Indians of Nevada (Train *et al*, 1941). The same writers mention uses of *W. amplexicaulis* in combination with other plants, for treatments of syphilis and measles. The seeds of the various species were gathered, roasted, and ground by the Indians to make a farinaceous food (Coville, 1897).

ACKNOWLEDGMENTS

The writer takes this opportunity to acknowledge and express his appreciation of the efforts of the following persons who have contributed ideas or assisted in the completion of this project: Dr. Marion Ownbey and Dr. Hannah C. Aase who respectively supervised and directed the taxonomic and cytological investigations; Dr. G. L. Stebbins, Jr., who furnished critical cytological material and comments concerning certain species; the large number of amateur or professional botanists who provided seeds or specimens; and the curators of the indicated herbaria who generously loaned the material in their charge.

Taxonomy[4]

WYETHIA Nuttall

Wyethia Nutt. in Jour. Acad. Phila. **7**:39. 1834.
Alarçonia DC., Prodr. **5**:537. 1836.
Melarhiza Kellogg in Proc. Calif. Acad. Sci. **1** (ed. 2): 37. 1873.

Roots perennial, fusiform, thick, becoming stout in older plants, covered by a thick bark. Crown branching below the ground to produce thick, erect, cylindrical underground stems. Aerial stems herbaceous, erect or ascending, in some species prostrate before anthesis, leafy, usually unbranched, glabrous or variously pubescent, with or without enlarged basal leaves. Leaves alternate, linear, lanceolate, or deltoid-ovate, entire or sometimes irregularly serrate or dentate, glabrous or variously pubescent. Heads usually large, solitary or several, terminal and from the axils of the upper leaves, radiate or rarely discoid (*W. invenusta*). Phyllaries 2- to 4-seriate, herbaceous or coriceous, linear-lanceolate to ovate, subequal, or the outer series often foliaceous and longer than the disk. Receptacle broadly convex; pales firm, conduplicate, persisting after the fall of the achenes. Disk-flowers perfect, light yellow; tube cylindrical, limb tubular to tubular-campanulate, 5-lobed, the base often more strongly developed on one side; anther appendages ovate, base sagittate; style branches slender, attenuate, hirsutulous from base to apex. Ray-flowers usually present, pistillate and fertile, yellow, cream-colored or white (*W. helianthoides*), oblong-lanceolate, notched at the apex, withering and deciduous after anthesis. Achenes of the disk-flowers fertile, 6-15 mm. long, quadrangulate or rhomboidal in cross-section, glabrous or variously pubescent,

4 The herbaria from which material has been available for study and from which specimens are cited in this treatment are indicated by the following abbreviations: CA—California Academy of Sciences Herbarium; CH—Personal Herbarium of J. H. Christ; CLOKEY—Personal Herbarium of Ira W. Clokey, University of California, Berkeley; CO—University of Colorado Herbarium; D—Dudley Herbarium, Stanford University; EWAN—Personal Herbarium of Joseph A. Ewan; G—Gray Herbarium, Harvard University; HG—Herbarium Greeneanum, University of Notre Dame; J—Personal Herbarium of Willis Linn Jepson; M—Missouri Botanical Garden Herbarium; NY—New York Botanical Garden Herbarium; P—Pomona College Herbarium; PA—Academy of Natural Sciences of Philadelphia Herbarium; RM—Rocky Mountain Herbarium, University of Wyoming; UAC—Intermountain Herbarium, Utah State Agricultural College; UC—University of California Herbarium, Berkeley; UO—University of Oregon Herbarium; US—United States National Herbarium; UW—University of Washington Herbarium; WS—State College of Washington Herbarium; WU—Willamette University Herbarium.

those of the ray-flowers dorsally compressed and trigonal, otherwise as the disk achenes. Pappus a crown of unequal, laciniate, persistent scales continuous with the carpel wall, united at the base and often prolonged into awns on the angles of the achene, or entirely lacking. Entire plant with a fragrant balsamic exudation. Anthesis vernal or early aestival.

Type Species: *Wyethia helianthoides* Nuttall.

KEY TO THE SPECIES AND VARIETIES

A. Basal leaves absent, reduced, or similar in size to the cauline leaves.

B. Leaves cordate-ovate or deltoid-ovate, two of the lowermost lateral nerves often prominent, giving the leaves a triple-nerved appearance. Plants of California.

C. Involucre campanulate. Phyllaries few in number, foliaceous and exceeding the disk. Heads small, few-flowered. Plants low.

D. Heads in clusters in the axils of the upper leaves which greatly overtop them. Ray-flowers short, few, inconspicuous. Leaves densely tomentose, becoming glabrate in age. Achenes about 10 mm. long. Pappus present ..... 1. *W. ovata.*

DD. Heads solitary, terminal. Ray-flowers numerous, conspicuous. Leaves glabrous, shining. Achenes 6-7 mm. long. Pappus lacking ..... 2. *W. Bolanderi.*

CC. Involucre hemispherical. Phyllaries numerous, linear, graduate, not greatly exceeding the disk. Heads large. Plants tall.

E. Plant green and shining, scabrous, glandular and sparsely hispid, especially on the petioles. Achenes about 6 mm. long. Pappus present, minute ..... 3. *W. reticulata.*

EE. Plant uniformly pubescent, the hairs interspersed with glands. Heads radiate or discoid. Pappus present or absent.

F. Plant densely short-pubescent. Ray-flowers present, ample. Achenes 8-12 mm. long. Pappus present, conspicuous ..... 4. *W. elata.*

FF. Plant pilose-hispid. Heads discoid, very rarely with a few short ray-flowers. Achenes 7-8 mm. long. Pappus lacking ..... 5. *W. invenusta.*

BB. Leaves all linear, the lateral nerves confluent distally, forming two submarginal nerves.

G. Phyllaries very long-attenuate from short, dilated bases, loosely imbricate, the pubescence of coarse multicellular hairs more or less restricted to the margins. Kane County, Utah, and adjacent Arizona ..... 6a. *W. scabra* var. *attenuata.*

GG. Phyllaries not long-attenuate, more closely imbricate, the pubescence, of the inner series at least, distributed uniformly.

H. Phyllaries very closely imbricate, the outer conspicuously recurved-spreading, all clothed with a very dense coat of short, fine, appressed hairs; upper ends of the bracts bearing enlarged bases of coarse hairs. Southwestern Colorado and adjacent corners of New Mexico, Arizona, and Utah ..... 6b. *W. scabra* var. *canescens.*

HH. Phyllaries moderately imbricate, more or less erect, the outer series pubescent mostly on the margins, the inner series more uniformly clothed with finer, more appressed hairs. Wyoming and northern Utah ..... 6. *W. scabra.*

AA. Basal leaves present and usually much larger than the cauline leaves.

I. Outer phyllaries very broad and greatly exceeding the disk. Heads very large, solitary, terminal.

JJ. Plant densely white-tomentose, becoming glabrate in age. Achenes 12-15 mm. long ..... 8. *W. helenioides.*

I. Outer phyllaries bract-like and not or little exceeding the disk. Heads large or medium-sized, one or more.

K. Plant very densely white-tomentose, becoming glabrate in age. Involucre campanulate. Phyllaries few. Ray-flowers few, short ..... 9. *W. mollis.*

KK. Plant glabrous, hirsute or otherwise pubescent but not tomentose. Involucres, at least those of the upper heads, hemispherical. Phyllaries numerous. Ray-flowers numerous, ample.

L. Phyllaries conspicuously ciliate on the margins. Heads usually solitary.

M. Ray-flowers white or cream-colored. Foliage light green, sparsely pilose and ciliate on the margins. Basal leaves abruptly narrowed to a usually winged petiole. East of the Cascade-Sierra Axis ..... 10. *W. helianthoides.*

MM. Ray-flowers yellow. Foliage dark green, softly appressed-pubescent to hirsute and scabrous. Basal leaves tapering to the petiole. West of Cascade-Sierra Axis ..... 11. *W. angustifolia.*

LL. Phyllaries glabrous or pubescent, not ciliate. Heads several.

N. Heads small, 1-3 cm. broad, on long, slender peduncles. Foliage sparsely and minutely pubescent. Basal leaves oblong-lanceolate, 1.5-4.0 cm. broad. Eastern Humboldt and adjacent Trinity and Mendocino counties, California ..... 12. *W. longicaulis.*

NN. Heads larger. Foliage glabrous or hirsute. Basal leaves larger and broader. East of Cascade-Sierra Axis.

O. Plant entirely glabrous, resin-varnished. Upper leaves clasping ..... 13. *W. amplexicaulis.*

OO. Plant densely hirsute to glabrate. Upper leaves petiolate ..... 14. *W. arizonica.*

Section 1. **Agnorhiza** (Jepson) comb. nov.

Agnorhiza Jepson, Man. Fl. P. Calif., p. 1077, 1925, as section in *Balsamorhiza.*

Basal leaves absent or greatly reduced; leaves falsely triple-nerved by the accentuation of two of the lowermost nerves or by anastomoses of the lateral nerves.

Type Species: *Helianthus* (*?*) *invenustus* Greene.

Five of the six species included in this section are very restricted in their distributional area, one of these, *W. reticulata,* being known definitely from a very small area near Rescue, El Dorado County, California. They are apparently species of long standing, conservative, and depleted of biotypes.

Wyethia scabra, included in this section by reason of the triple-nerved leaves and lack of basal leaves, does not possess the broad leaves characteristic of the other species.

1. WYETHIA OVATA Torrey and Gray

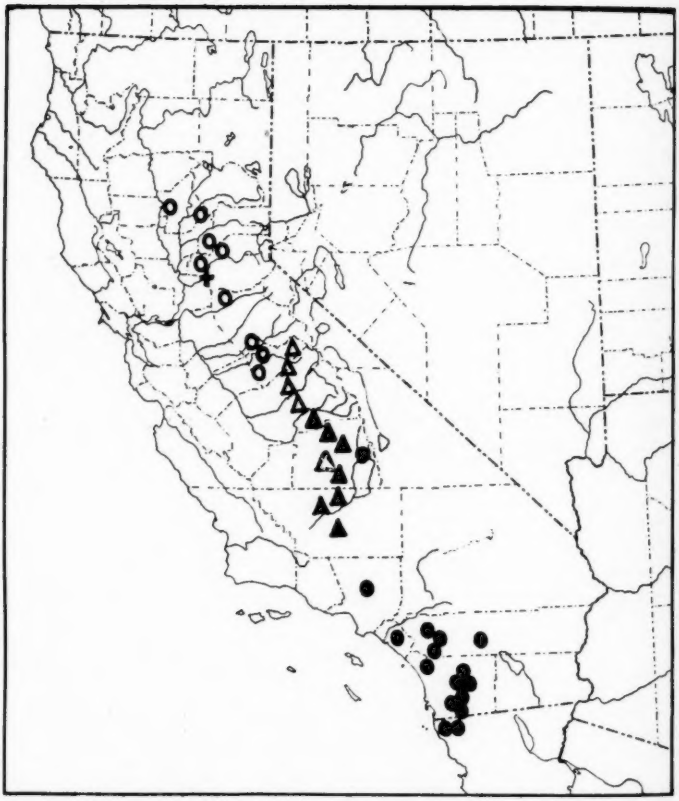
Wyethia ovata Torrey & Gray ex Torrey in Emory, Notes Mil. Reconnois. 143. 1848; Abrams in Bull. Torr. Bot. Club **32**:541. 1905. Not *W. ovata* A. Gray, 1868. *W. coriacea* A. Gray in Proc. Am. Acad. **11**:77. 1876.

Stems few, stout, 1-3 dm. high, much exceeded by the leaves. Plant silky-villous throughout, becoming glabrate. Basal leaves reduced to scales or club-shaped rudiments. Cauline leaves broadly ovate to suborbicular, truncate or subcordate at the base; blades 7-20 cm. long, acute or mucronate at the apex, coriaceous, coarsely reticulate, entire, two of the lowermost lateral nerves usually conspicuous, giving the leaves a triple-nerved appearance; petioles one half to equaling or exceeding the length of the blades. Heads 1.5-2 cm. broad, short-pedunculate or almost sessile, in clusters from the axils of the upper leaves and somewhat hidden by them. Involucre narrowly campanulate; outer series of 4 to 6 erect, broadly linear, foliaceous phyllaries which are usually dilated above and equal or exceed the short rays; inner phyllaries uniform, rigid, linear-oblong, equaling the disk, these and the pales silky-villous toward the acute or mucronate apices. Disk-flowers 12 to 20, glabrous. Ray-flowers yellow, few (5 to 8), about 1.5 cm. long, inconspicuous, glabrous. Achenes about 10 mm. long, glabrous, with a shallow, coroniform pappus projected on the angles into short awns.

Type Locality.—"Abundant on the west side of the Cordilleras of California." Abrams (1905) discusses the type locality and finds it to be on the Mesa Grande between Warner's Ranch and San Isabel in what is now San Diego County, California. The type specimen, *Emory*, Dec. 4, 1846, at New York Botanical Garden, is not available at this time, but its identity is not questioned.

Distribution.—Grassy hillsides and open or wooded mountain slopes, Tulare, Los Angeles, Riverside, Orange, and San Diego counties, California, and in adjacent northern Lower California (map 2). Late May to early August.

CALIFORNIA. TULARE CO.: vicinity of Lloyd Mt., 1800 m. alt., Kern River, July 18, 1895, *Dudley 786* (D); Coyote Creek, 1950 m. alt., basin of the Upper Kern River, July, 1904, *Hall & Babcock 5573* (D, UC); near Trout Meadows, 1860 m. alt., July 16, 1908, *Hall & Hall 8387* (UC). LOS ANGELES CO.: Horse Flats, 1650 m. alt., July 9, 1933, *Duran 3508* (CA, D, EWAN, G, M, NY, P, RM, UAC, UC, UO, US, WS), June 15, 1932, *Ewan 7335* (EWAN, P); Chilao, 1620 m. alt., Aug. 11, 1934, *Ewan 8410* (EWAN, UC). RIVERSIDE CO.: Nuevo, June 18, 1894, Brandegee (UO); Thomas Valley, 1350 m. alt., June, 1901, *Hall 2170* (D, M, PA, UC, US); Barkers Meadow, San Jacinto Mts., June 14, 1921, *Jaeger 1054* (P, UC); MacMullin Trail, San Jacinto Mts., 1080 m. alt., June 16, 1921, *Jaeger 278* (P); San Luis Rey Bridge, Temecula, May 9, 1934, *Jones* (P); Hemet Valley, San Jacinto Mts., 1350 m. alt., June 18, 1929, *Meyer 783* (J, UC), June 23, 1922, *Munz 5783* (CLOKEY, P). ORANGE CO.: Los Pinos Potrero, Main Divide Motorway, Santa Ana Mts., 900 m. alt., June 18, 1935, *Everett 7198* (CA, D, G, M, NY, P, UC, US). SAN DIEGO CO.: between Ballena and Santa Isabel, June 19, 1903, *Abrams 3768* (D, G, M, NY, P, PA, UC, UO, US); Cuyamaca Lake, June 30, 1903, *Abrams 3955* (D, G, M, NY, P, US), June 27, 1923, *Munz & Harwood 7201* (NY, P), May 30, 1931, *Wolf 2217* (CA, D, UC); Witch Creek, June, 1894, *Alderson* (D, G); Julian, 1896, *Brandegee* (NY, UC), June, 1882, *Parish & Parish 241* (D, G, UO, WS); Palomar (Smith) Mt., 1500 m. alt., July 6, 1904, *Chandler 5409* (NY, RM, UC), July 13, 1929, *Jones 25037* (CA, G, M, NY, P, UC), June 1-4, 1897, *Parish 4412* (G, J, M, NY, US); Laguna Mts., June 6, 1885, *Cleveland* (D, UC), June 25, 1924, *Munz 8378* (P); Descanso, June 24, 1919, *Eastwood 9073* (CA, G), June 20, 1932, *Epling, Darsie, Knox, & Robison* (CA, D, EWAN, M, NY, RM, UC, US), July 24, 1918, *Spencer*



Map 2. Distribution of some species of *Wyethia*, section Agnorhiza: open circles, *W. Bolanderi*; open triangles, *W. elata*; solid triangles, *W. invenusta*; solid disks, *W. ovata*; plus sign, *W. reticulata*.

943 (G, NY, P); Warner's Ranch, May, 1899, *Hall 1195* (D, NY, UC), *Hayes 441* (G, US); s. of Doane Valley, Palomar Mts., 1500 m. alt., June 22, 1924, *Munz 8280* (G, P); Mesa Grande, July 30, 1875, *Palmer 168* (G type of *W. coriacea*, NY, PA), May 28, 1919, *Spencer 1156* (CA, G, NY, P); San Diego, 1875, *Palmer 256* (US); near Campo, June, 1880, *Parish 242* (G); Pine Hills, June 3, 1917, *Spencer 507* (G, M, NY, P); near Henshaw Dam, Palomar Mts., June 14, 1928, *Wiggins 3131* (D, UC.)

LOWER CALIFORNIA. "Mountains, northern Lower California," July 7, 1885, *Orcutt 314* (UC, US); Agua Caliente, June, 1880, *Vasey* (US).

The type specimen of *W. ovata* var. *funerea* Jepson,[5] described from a single collection, has not been available, hence no disposition of the name is made at this time. The original description follows. "Herbage not tomentose, rather densely covered with short gland-tipped hairs; leaves shorter and broader than in the species, 4 to 10 in. long, 2 to 5 in. wide, mostly rather coarsely few-toothed.—Funeral Mountains, Death Valley (Jepson 6903, type)."

2. **Wyethia Bolanderi** (A. Gray) comb. nov.

Balsamorhiza Bolanderi A. Gray in Proc. Am. Acad. **7**:356. 1868.

Stems few, slender, purplish, glandular above, becoming glabrous in older plants, 1.5-3 dm. high, not exceeded by the leaves. Basal leaves reduced to scale-like bracts. Cauline leaves 2 to 4, ovate, obliquely truncate to deeply cordate at the base; blades 4-12 cm. long, acute or obtuse, mucronate at the apex, very glutinous when young, becoming coriaceous and coarsely reticulate with age, pinnately veined or tending to have a triple-nerved appearance, entire; petiole 1/4 as long as to equaling or exceeding the leaf. Heads solitary and terminal, 2-2.5 cm. broad, sessile or short-pedunculate. Involucre broadly campanulate; outer phyllaries 4 to 6, erect, foliaceous, ovate to ovate-lanceolate, 2-3 cm. long, acute or obtuse, mucronate at the apex, similar in texture to the leaves, exceeded by the ample ray-flowers, tomentose-ciliate when young, later glabrous; inner phyllaries shorter and narrower; pales linear, densely ciliate above. Disk-flowers usually more than 20, glabrous. Ray-flowers yellow, 7 to 12, about 3 cm. long, glabrous. Achenes about 7 mm. long, glabrous. Pappus lacking.

Type Locality.—Auburn, Placer County, California.

Distribution.—Foothills of the Sierra Nevada, from Butte County to Mariposa County, California (map 2). March and April.

CALIFORNIA. BUTTE CO.: Durham, April 9, 1932, *Morrison* (CA). YUBA CO.: near top of Texas Hill, April 12, 1930, *Eastwood* (CA). NEVADA CO.: American Ranch Hill, near Grass Valley, April 30, 1929, *Applegate 5553* (D). PLACER CO.: Auburn, 1865, *Bolander 4526* (G type); Forest Hill, *ex herb. Rattan* (D). AMADOR CO.: Savage Hill, 600 m. alt., May 1891, April, 1893, *Hansen 168* (D, P, UC). TUOLUMNE CO.: Big Oak Flat Road between Coulterville and Jacksonville, April 11, 1937, *True 645* (CA). MARIPOSA CO.: 4 1/2 mi. n. of Coulterville, 735 m. alt., April 11, 1937, *Carter 1240* (CA, D, P, UC, UW, WS); Bear Valley, May 2, 1892, *ex herb. Congdon* (D, UC); 4 mi. n. of Coulterville, Mar. 21, 1936, *Mason 11029* (UC, UW).

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[5] Man. Fl. Pl. Calif., p. 1170. 1925.

3. WYETHIA RETICULATA Greene

Wyethia reticulata Greene in Bull. Cal. Acad. Sci. 1(1):9. 1884.

Plant about 6 dm. high, covered with minute, dark-colored glands, sparsely hispid, becoming merely scabrous from the persistent swollen stumps of the hairs. Stem slender, rigid. Enlarged basal leaves absent. Cauline leaves about 15, reduced upwards, the lowermost rudimentary and withering early, the largest 12-15 cm. long, 5-8 cm. wide, ovate-lanceolate to deltoid, acute at the apex, truncate to subcordate at the base, glossy, becoming coriaceous and strongly reticulate, entire to serrulate, on petioles one-fourth to one-third the length of the blades, two of the lowermost lateral nerves usually more conspicuous than the rest, giving the leaf a triple-nerved appearance. Heads 1 to 4, 1-2 cm. broad. Involucre hemispherical; outer phyllaries unequal, about equaling the disk, lance-linear, dilated above, acute, with squarrose tips, becoming coriaceous and reticulate; inner phyllaries rigid, shorter. Disk-flowers sparsely covered with the minute glands which characterize the rest of the plant. Ray-flowers yellow, 10 to 16, sparsely glandular on the dorsal surface. Achenes about 6 mm. long, glabrous, with a very minute, coroniform, awnless pappus.

Type Locality.—Sweetwater Creek, Eldorado County, California.

Distribution.—On red stony clay loam (Sierra Stony Clay Loam), north and northeast slopes of gently rolling dry chaparral-covered hills, Sweetwater Creek, Weber Creek, and vicinity of Rescue, foothills of the Sierra Nevada, Eldorado County, California (map 2). May to July.

CALIFORNIA. ELDORADO CO.: near Weber Creek, May 20, 1907, *Brandegee* (UC), July, 1883, *Greene* (M); Sweetwater Creek, Aug. 5, 1883, *Curran* (CA type, G), May, 1884, (J), June, 1884, (D), July, 1884, (D, WS); Green Valley road, ¼ mi. w. of Rescue, S. 23, T. 10 N., R. 9 E., 425 m. alt., June 30, 1945, *Robbins 2013* (WS); Simpson's Ranch, Sweetwater Creek, June, 1907, *Simpson* (UC). SACRAMENTO CO.: "Folsom," 1883, *Curran* (D) [Data perhaps only approximate].

During the early summer of 1945, Mr. G. Thomas Robbins made a careful search of the type locality, hoping to rediscover this species which had been last collected in 1907. He found several colonies and added considerable to our knowledge of it. In addition to the locality cited above, he found *W. reticulata* at the following stations: (1) along Green Valley Road, about 2 miles west of Rescue (T. 10 N., R. 9 E., probably section 22); (2) on a road leading to the cabin of Mr. John Outcalt, about 2½ miles north and a little west of Rescue (S. 10 or 11, T. 10 N., R. 9 E.); (3) from Paul Friedman's irrigation ditch to the Rose Kimberly mine at a point nearly 2 miles north of Rescue overlooking Weber Creek near the mouth of Dry Creek (S. 11 or 12, T. 10 N., R. 9 E.); (4) one mile north of Rescue on the Deer Valley Road.

The plants grow in spaced groups of nearly pure composition that vary from a few individuals to dense stands of 100 or more. These groups favor the shade or partial shade of live oaks (*Quercus Wislizenii*) or chaparral shrubs (principally *Adenostoma fasciculatum* and *Arctostaphylos viscida*). The species appears to be aggressive in colonizing disturbed areas.

4. WYETHIA ELATA H. M. Hall

Wyethia elata H. M. Hall in Univ. Cal. Publ. Bot. **4**:208. 1912.
W. ovata A. Gray in Proc. Am. Acad. **7**:357. 1868, not T. & G., 1848.

Plant 5-10 dm. high, densely short-pubescent, the hairs interspersed with minute glands. Enlarged basal leaves absent. Cauline leaves reduced upwards, the lowermost rudimentary and withering early, the largest 15-20 cm. long, ovate-lanceolate to deltoid, acute at the apex, truncate to subcordate at the base, entire to shallowly dentate or serrate, on petioles about ¼ the length of the blades, the principal veins prominent beneath, two of the lower lateral ones usually conspicuous, giving the leaf a triple-nerved appearance. Heads 1 to 4, 2.5-4 cm. broad. Involucre hemispherical; outer phyllaries unequal, lanceolate, dilated above, acute or acuminate, squarrose or appressed, equaling or exceeding the disk; phyllaries and pales densely pubescent. Disk-flowers glabrous. Ray-flowers yellow, 10 to 14, glandular. Achenes 8-12 mm. long, glabrous or with a few hairs on the upper portion. Pappus coróniform, conspicuous, projected into short, stout awns on the angles of the achene.

Type Locality.—Clark's Ranch (now Wawona), 1,200 m. alt., Mariposa County, California.

Distribution.—Open pine woods, 900-1,200 m. alt., foothills of the Sierra Nevada in Mariposa, Madera, Fresno, and Tulare counties, California (map 2). June to August.

CALIFORNIA. MARIPOSA CO.: Clark's Ranch, 1200 m. alt., 1866, *Bolander 6167* (G type, M, US); Yosemite Park, July, 1900, *Cook & Reynolds* (P); Darrah, Aug. 14, 1892, *Congdon 38* (UC, D); Yosemite Valley, July 4, 12, 1901, *Grant 4150* (D); Wawona Valley, 1200 m. alt., July 21, 1924, *Howell 472* (CA); near Yosemite, Sept., 1879, *Lemmon* (UC). MADERA CO.: The Pines, Bass Lake, Sierra National Forest, July 18, 1912, *Abrams 4977* (D, G); North Fork, San Joachin River, June, 1937, *Dudley* (CA); North Fork and vicinity, May 30, to June 8, 1903, *Griffiths 4630* (US); Niponiwassee, June 16, 1915, *Hall 10047* (M, NY, RM, UC, US); below Fish Camp, July 2, 1930, *Hall 12798* (D); 4 mi. s. of Miami Ranger Station, 1200 m. alt., July 16, 1938, *Mason 11952* (CA, D, M, NY, P, RM, UAC, UC, WS); 7 mi. s.e. of Oakhurst, June 1, 1940, *Sweet* (WS); Fish Camp, June 22, 1937, *Winblad* (CA). FRESNO CO.: 1 mi. n. of Auberry, 900 m. alt., June 17, 1935, *Bullard 83* (D, UC). TULARE CO.: Balch Park, June 7, 1937, *Winblad* (CA). COUNTY UNCERTAIN: "California," *Bridges 262* (G, NY, US); "foothills to Yosemite," 1872, *Gray* (G).

5. **Wyethia invenusta** (Greene) comb. nov.

Helianthus (?) *invenustus* Greene in Pittonia **1**:284. 1889.
Balsamorhiza invenusta Coville in Contr. U. S. Nat. Herb. **4**:130. 1893.

Plant 3-6 dm. high, pilose-hispid, densely glandular above, becoming hispidulous below. Enlarged basal leaves absent. Cauline leaves slightly reduced upwards, the lowermost rudimentary and withering early, the largest 15-20 cm. long, ovate-lanceolate, acute at the apex, slightly oblique and either truncate or shallowly cordate at the base, entire or occasionally irregularly crenate, on petioles one-fourth to one-third the length of the blades, the principal veins prominent beneath, two of the lowermost lateral ones often

conspicuous, giving the leaves a triple-nerved appearance. Heads usually solitary, 2-3 cm. broad, discoid, or with a few short ray-flowers. Involucre hemispherical; outer phyllaries unequal, foliaceous, lanceolate, dilated above, acute or acuminate, erect or spreading, equaling and usually slightly exceeding the disk. Flowers about 1 cm. long, glabrous. Achenes dull black, rhomboidal in cross-section, 7-8 mm. long, glabrous, the apex developing knob-like projections on the angles. Pappus absent.

Type Locality.—"Mountains of Kern County, California."

Distribution.—Open woodlands, Fresno, Tulare, and Kern counties, California (map 2). July.

CALIFORNIA. FRESNO CO.: 5 mi. s. w. of General Grant National Park, 1500 m. alt., July 1, 1940, *Rose 40722* (CA). TULARE CO.: 1 mi. below Quaking Aspen Meadow, watershed of South Fork of Middle Fork of Tule River, July 26-28, 1941, *Bacigalupi, Wiggins, & Ferris 2635* (D); Giant Forest, July, 1905, *Brandegee* (UC); South Fork, Kaweah River, July 21, 1904, *Culbertson 4413* (CA, D, G, P, UC); below Mill Colony Road, Kaweah River Valley, Aug. 9, 1895, *Dudley 1182* (D); North Fork of Middle Fork of Tule River, 1200 m. alt., July 11, 1908, *Hall & Hall 8340* (UC); East Fork of Kaweah River at Cold Spring, July 24, 1942, *Howell 17050* (CA); Mineral King, July 30, 1936, *Winblad* (CA). KERN CO.: grade over Greenhorn Mountain, about 1.5 mi. e. of Alta Sierra Store, 1740 m. alt., July 14, 1941, *Bacigalupi & Ferris 2479* (D, G); ¼ mi. s. e. of main Breckinridge Meadow, Breckinridge Mountain, July 15, 1939, *Brittan 98* (WS); above Parson's Mill, vicinity of Poso Creek Valley, July 9, 1895, *Dudley 587* (D); "Kern Co.," 1888, *Palmer 105* (HG type, photograph WS).

Although this species is generally regarded to be entirely rayless, occasional collections (*Culbertson 4413*) bear from one to three ray-flowers which are about ½ inch long.

6. WYETHIA SCABRA Hooker

Wyethia scabra Hook. in Lond. Jour. Bot. **6**:245. 1847.

Stems numerous, 1.5-4 dm. high, slender, very pale or white, hispid the entire length, as are all vegetative parts, the long multicellular hairs becoming more dense toward the inflorescence, finally breaking off and leaving swollen bases which cause the surface of the plant to be very harshly scabrous. Enlarged basal leaves absent. Lower cauline leaves rudimentary, withering early. Leaves largest at the middle of the stem, linear, very stiff and harsh, entire, sessile, 3-15 cm. long, 3-17 mm. wide, abruptly narrowed or truncate at the base, mucronate at the apex, the nerves very pale, the lateral ones confluent toward the margin giving the leaves a triple-nerved appearance. Heads solitary, terminal, about 2 cm. broad. Involucre hemispherical; outer series of phyllaries narrowly lanceolate to linear, attenuate, from rather broad, ovate bases, pubescent mostly on the margins; inner series broader, rigid, ovate-lanceolate with attenuate tips, the hairs finer, more appressed, and covering the entire bract. Disk-flowers glabrous. Ray-flowers 10 to 13, about 3.5 cm. long, lemon-yellow, rather densely pubescent on the tube and dorsally along the nerves. Pales deeply carinate above, pubescent on the midribs and margins.

Achenes completely glabrous, 6-8 mm. long. Pappus short, coroniform, without conspicuous awns.

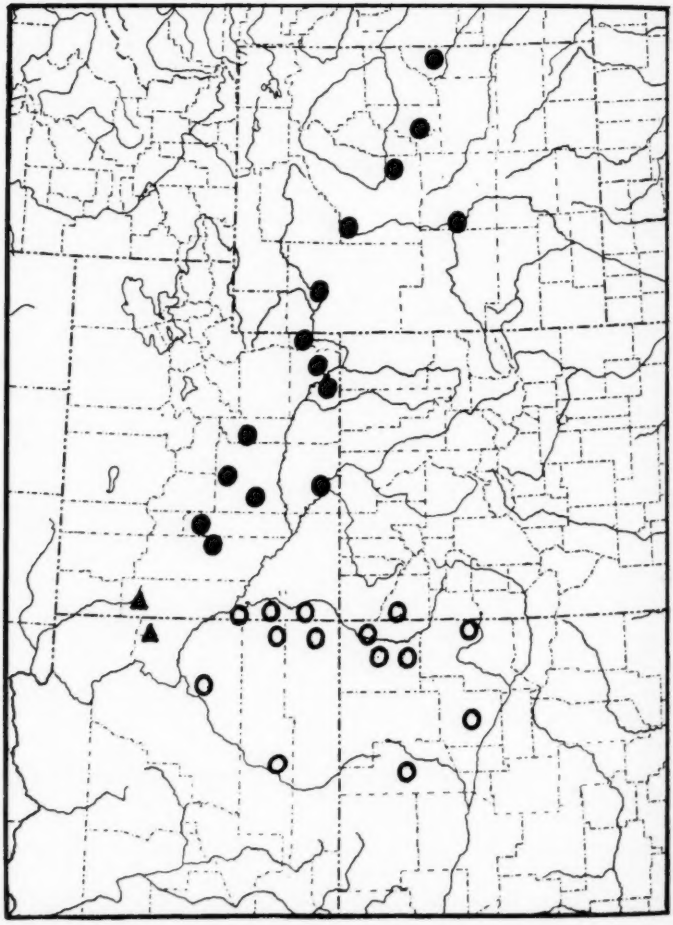
Type Locality.—"Clayey argillaceous declivities of the high hills of the Upper Colorado River," July, *Geyer 96*. The type specimen in the Kew Herbarium is not available at this time. Geyer's travels through what is now Wyoming followed the route of the Oregon Trail, "passing up the Platte River to Fort Laramie, thence through the most northerly narrow range of the 'Black Hills' across Saline Desert to the 'Red Buttes' and 'Rock Independence' at Sweet-water or Eau Sucree River, thence to 'Wind River Mountains' and across the 'Upper Colorado' near the mouth of 'Grand Sableuse' to 'Fort Hall' and 'Boiling Springs' of 'Lewis River.'" (Geyer, 1845, p. 484). The type collection of *Wyethia scabra* probably came from a point along the Green River ("Upper Colorado" of Geyer's report) near the mouth of the Big Sandy River ("Grand Sableuse" of Geyer's report) in Sweetwater County, Wyoming.

Distribution.—Deserts, central and southwestern Wyoming to northeastern and central Utah (map 3). June and July.

WYOMING. SHERIDAN CO.: Dayton, 1200 m. alt., Sept., 1899, *Tweedy 2080* (NY). NATRONA CO.: Alcova, June 29, 1901, *Goodding 145* (G, M, NY, P, RM, UC, US). FREMONT CO.: "Wind River Chain," July 31, 1842, *Frémont* (NY); Badwater Creek, Bonneville, June 26, 1910, *Nelson 9430* (G, M, NY, RM, UC); 10 mi. e. of Shoshoni, July 2, 1935, *Williams 2318* (G, M, RM, UC, WS). SWEETWATER CO.: Green River, June 15, 1900, *Nelson 7233* (CO, EWAN, G, M, NY, P, RM, UAC, US). June 19, 1923, *Payson & Armstrong 3202* (CO, G, M, P, PA, RM).

UTAH. DAGGETT CO.: 1 mi. s. of Manila, July 12, 1935, *Maguire & Piranian 12376* (UAC); Sheep Creek, vicinity of Flaming Gorge, 1800 m. alt., June 3, 1932, *Williams 506* (CA, G, M, NY, RM, UAC). UINTAH CO.: s. e. of Jensen, 1650 m. alt., June 27, 1933, *Graham 8277* (G, M); 14 mi. n. of Vernal, 1800 m. alt., June 17, 1937, *Rollins 1755* (G, M, NY). CARBON CO.: Price, Sept., 1888, June 29, 1898, July 3, 1903, *Jones* (D, M, P, US), June 20, 1898, June 12, 1899, *Stokes* (D, NY, UC, US). EMERY CO.: Ferron, 1710 m. alt., June 18, 1894, *Jones 5453* (M, NY, P, RM, UC, US); San Rafael Swell, May 8, 1914, *Jones* (P); mesa n. of Emery, July 9, 1908, *Tidestrom 1437* (US). WAYNE CO.: Bicknell, 2250 m. alt., May 20, 1934, *Harrison & Larsen 7523* (UC). GARFIELD CO.: 50 mi. s.w. of San Rafael, 1500 m. alt., May 18, 1934, *Harrison & Larsen 7438* (UAC). COUNTY UNCERTAIN: Courthouse Wash, June 16, 1913, *Jones* (P).

Wyethia scabra is a polytypic species with three morphologically recognizable, geographically discontinuous races. Their morphological discontinuity is manifested by differences in the shape and indument of the phyllaries. The most striking departure from the historical type of the species is found in the race (var. *attenuata*) inhabiting Kane County, Utah, and adjacent Coconino County, Arizona. In this race the phyllaries are extremely long, narrow, and very loosely imbricate, with the stout hairs tending to be restricted to the margins. In the second race (var. *canescens*), occupying the adjacent corners of Arizona, New Mexico, Colorado, and Utah, separated from the first by the canyons of the Colorado and Green rivers, a dense over-all pubescence of short, stiff hairs completely covers the phyllaries, which are very closely imbricate, the outer having conspicuously recurved tips. When this variety



Map 3. Distribution of *Wyethia scabra* and varieties: solid disks, *W. scabra;* solid triangles, *W. scabra* var. *attenuata;* open circles, *W. scabra* var. *canescens.*

does not winter-kill, the upper portion of the stem sometimes branches, an unusual condition in the genus.

The species in the original sense is found in Wyoming and Utah. The pubescence of the phyllaries is somewhat intermediate, but only a few specimens from south-central Utah, where this race approaches the distributional area of var. *canescens*, might be said to exhibit primary intergradation.

6a. **Wyethia scabra** var. **attenuata** n. var.

Plantae plerumque altiores (5.5 dm. in typo), glabriores; phyllariae laxissime imbricatae, elongatissimae, lineares, e basi brevi-dilato attenuatae; plerumque margines phyllariarum pilosi.

Plant larger (5.5 dm. in the type), more glabrate. Phyllaries very loosely imbricate, greatly elongate, linear, attenuate from the short, dilated bases; hairs tending to be restricted to the margins. Otherwise similar to the species.

Type Locality.—Sand dune area in juniper belt, 10½ mi. n. of Kanab, 1,500 m. alt., Kane County, Utah.

Distribution.—Kane County, Utah, and adjacent Coconino County, Arizona, 1,500-2,100 m. alt. (map 3). May to July.

UTAH. KANE CO.: 10½ mi. n. of Kanab, 1500 m. alt., July 11, 1938, *Carter 1424* (UC, WS type); along Virgin River near Kanab, June 24, 1933, *Eastwood & Howell 1124* (CA, US); near Willow Tank, May 10, 1939, *Harrison 9090* (CLOKEY); 10 mi. n. of Kanab, Aug. 23, 1937, *Hitchcock 3208* (D, P, UW), June 29, 1935, *Maguire 12283* (UAC, UC, UW); 6 mi. n. of Kanab, 1500 m. alt., Aug. 9, 1938, *Hitchcock, Rethke, & van Raadshooven 4530* (EWAN, RM, UAC, UC, UW, WS); Three Lakes Canyon n. of Kanab, Aug. 8, 1932, *Kelly* (CA); 12 mi. n. of Kanab, 1650 m. alt., July 19, 1941, *Munz 17008* (WS), July 6, 1938, *Rollins & Chambers 2447* (D, G, UAC).

ARIZONA. COCONINO CO.: House Rock, June 17, 1930, *Jones* (P).

6b. **Wyethia scabra** var. **canescens** n. var.

Phyllariae arcte imbricatae, exteriores recurvo-divaricatae, omnes pili brevibus tenuibus appressis densissime vestitae; apices phyllariarum truncis pilorum dilatis praeditae.

Phyllaries closely imbricate, the outer conspicuously recurved-spreading, all clothed with a very dense coat of short, fine, appressed hairs; apices bearing enlarged stumps of hairs. Otherwise as in the species.

Type Locality.—Dry, rocky ground s. of Mexican Hat, San Juan River near Utah-Arizona boundary, San Juan County, Utah.

Distribution.—Extreme southeastern Utah, southwestern Colorado, northeastern Arizona and west-central and northwestern New Mexico (map 3). May to July.

COLORADO. LA PLATA CO.: near Rio La Plata, July, *Brandegee 1099* (G, M, UC).

UTAH. GRAND CO.: Cisco, May, 1896, *Jones* (UO), SAN JUAN CO.: junction of Nokai Creek and San Juan River, June 18, 1938, *Cutler 2279* (CA, M); near Red Bud Pass, Bernheimer Trail to Rainbow Bridge, 1140 m. alt., Aug. 3, 1939, *Cutler*

2857 (D); Willow Creek, July 13, 1895, *Eastwood 57* (G, US); Monument Pass, Sept. 14, 1938, *Eastwood & Howell 6687* (CA, UAC); s. of Mexican Hat, San Juan River near Utah-Ariz. boundary, June 27, 1930, *Goodman & Hitchcock 1352* (CA, D, G, M, NY type, RM, UC); 14 mi. s. of Bluff, June 29, 1933, *Maguire, Richards, Maguire, & Hammond 5659* (G, M, UAC, UC).

NEW MEXICO. RIO ARRIBA CO.: Ghost Ranch, Rio Chama drainage, June 23, 1923, *Goodwin* (G). SAN JUAN CO.: near Shiprock, 1260 m. alt., July, 1930, *Hutchinson 3794* (EWAN); Huerfano Mesa near Bloomfield, July 4, 1929, *Mathias 622* (M, P); 20 mi. s. of Fruitland, Aug. 6, 1904, *Wooton 2617* (US). SANDOVAL CO.: vicinity of San Ysidro, 1700 m. alt., Oct. 2, 1926, *Arsène & Benedict 17607* (US). VALENCIA CO.: Inscription Rock, Nov. 18, 1853, *Bigelow* (G, NY).

ARIZONA. APACHE CO.: 3 mi. n. e. of Rock Point, 1590 m. alt., June 11, 1937, *Peebles 13516* (US); 5 mi. n. e. of Dinnehotso, 1515 m. alt., June 21, 1939, *Peebles 14361* (NY, US), *Shreve 8973* (UC); north end of Carrizo Mts., July 30, 1911, *Standley 7439* (NY, US). NAVAJO CO.: 7 mi. n. w. of Chilchinbito on road to Kayenta, July 23, 1940, *Ferris 10196* (CLOKEY, D); Monument Valley, 1605 m. alt., June 4, 1935, *Peebles & Fulton 11936* (G); 2 mi. s. of Holbrook, June 17, 1901, *Ward* (NY, US). COUNTY UNCERTAIN: "Little Colorado" [probably Coconino Co.], June 10, 1890, *Jones* (M, P, UC, US); Burro Springs, July 25, 1935, *Whiting* (US).

Section 2. ALARÇONIA (DC.) Nuttall

Alarçonia DC., Prodr. **5**:537. 1836, as genus; Nuttall in Trans. Am. Phil. Soc. II. **7**:353. 1840, as section.

Heads very large, solitary, the outer series of phyllaries greatly exceeding the disk. Basal and cauline leaves elliptic-ovate, very large. Achenes 10-15 mm. long, the largest in the genus. Pappus calyx-like, conspicuous, often prolonged into stout awns on the angles. Median vascular bundles of corolla-lobes well developed.

Type Species: *Wyethia helenioides* (DC.) Nutt.

7. WYETHIA GLABRA A. Gray

Wyethia glabra A. Gray in Proc. Am. Acad. **6**:543. 1865.

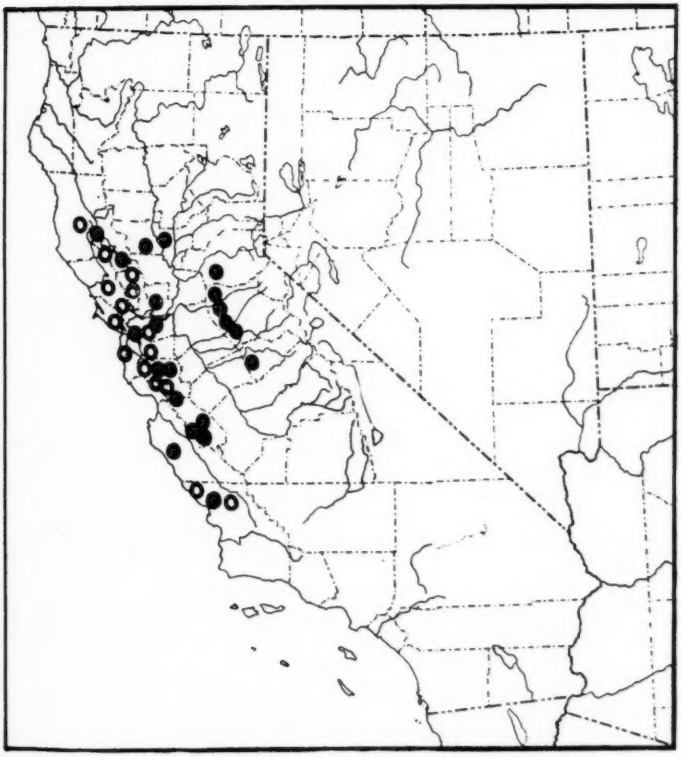
Plant 1.5-4 dm. high; foliar organs very sparsely short-pilose or glabrous, glandular. Basal leaves very large, 3.5-4 dm. long, about 1 dm. wide, oblong-lanceolate to elliptic-ovate, pinnately veined, often undulate-margined, acute or obtuse, abruptly narrowed to short petioles about one-fourth the length of the blades, entire or sometimes irregularly serrate-dentate, glossy. Cauline leaves 3 to 6, similar but smaller, about 1.5 dm. long. Heads usually solitary and terminal, occasionally with a second smaller one below, very large, 3.5-6 cm. broad, shallowly hemispherical. Outer phyllaries very large, ovate, broadest above the base, foliaceous, spreading, acute or obtuse, much exceeding the disk, equaling and usually exceeding the ray-flowers; inner series similar but reduced. Disk-flowers glabrous, with minute glands. Ray-flowers about 12, 3-4 cm. long, glabrate, yellow. Achenes 10-12 mm. long, puberulent above. Pappus crown prolonged into short, broad awns.

Type Locality.—Pass El [Paso] Robles, in Salinas Valley, north of San Luis Obispo, San Luis Obispo County, California.

Distribution.—In shade, Coast ranges, Mendocino County to San Luis Obispo County, California. The range of this species is coincident with that of the next with the exception that *W. glabra* does not occur east of the Sacramento Valley (map 4). March to May.

CALIFORNIA. LAKE CO.: Kelseyville, April 26, 1923, *Blankinship* (CA); 6 mi. e. of Bartlett Springs, May 7, 1928, *Kildale 4955* (D). MENDOCINO CO.: Ukiah, June 13, 1913, *Eastwood 3313* (CA); Pieta, Russian River, May 17, 1943, *Jepson 20832, 20834**[6] (J). SONOMA CO.: Rincon Ridge, Mar. 18, 1928, *Baker 2727b* (UC); Petaluma, April, 1880, *ex herb. Congdon* (D); Altruria, April 7, 1900, *Eastwood* (UC); El Verano, April, 1922, *Griffin* (CA); Santa Rosa, Mar. 28, 1902, *Heller & Brown* (NY, US). NAPA CO.: foot of Mt. St. Helena Grade, 3 mi. out of Calistoga, Mar. 28,

6 Intermediate specimens or putatively hybrid series, *W. angustifolia* x *W. glabra*, are indicated by an asterisk (*).



Map 4. Distribution of the species of *Wyethia*, section Alarçonia: open circles, *W. glabra*; solid disks, *W. helenioides*.

1926, *Bacigalupi 1271* (D); head of St. Helena Creek, May 15, 1938, *Eastwood & Howell 5524* (CA, UW); Oakville, May 2, 1870, *Kellogg* (D); Napa City, April, 1897, *Sonne* (UC). MARIN CO.: Ignacio, April 27, 1918, *Abrams 6891* (D); Rock Spring, Mt. Tamalpais, May 5, 1930, *Eastwood* (CA); base of Tamalpais, 1885, *Gray* (G); Lagunitas, April 28, 1918, *Grinnell* (D, NY); near landing, San Quentin, May 3, 1866, *Kellogg* (G, US); San Rafael, April, May, 1867, *Rattan* (D). CONTRA COSTA CO.: Mt. Diablo, May 30, 1915, *Eastwood 4493* (CA). ALAMEDA CO.: Alameda, 1876, *Vasey* (G). SAN MATEO CO.: Crystal Springs, June 10, 1912, *Eastwood 339* (CA, CLOKEY, G, NY); Belmont, June 17, 1893, *Burtt-Davy* (UC). SANTA CLARA CO.: Stanford University, April 20, 1902, *Abrams 2357* (D, M, NY, P, RM, US); foothills near Stanford University, April 15, 1902, *Baker 646* (G, M, NY, P, UC, US); foothills w. of Los Gatos, May 11, 1904, *Heller 7404* (D, G, M, NY, PA, RM, UC, US); New Almaden, 1865, *Torrey 229c* (G). SAN LUIS OBISPO CO.: Santa Lucia Mts., May 7, 1899, *Barber* (M, RM, UC); Paso Robles, 1860-62, *Brewer 522* (G type), April 17, 1909, *Condit & White* (UC), April 20, 1907, *Cobb* (UC), May 4, 1926, *Eastwood 13818* (CA), April 8, 1926, *Munz 10121* (P).

8. WYETHIA HELENIOIDES (DC.) Nuttall

Alarçonia helenioides DC., Prodr. **5**:537. 1836.
Wyethia helenioides (DC.) Nutt. in Trans. Am. Phil. Soc. II. **7**:353. 1840.
Melarhiza inuloides Kellogg in Proc. Calif. Acad. Sci. **1** (ed. 2): 37. 1873.

Plant 3-6 dm. high; stems, foliage, and bracts tomentose, becoming glabrate in age, resin-dotted. Basal leaves very large, about 3 dm. long, 1 dm. wide, oblong-lanceolate to elliptic-ovate, pinnately veined, often undulate-margined, acute or obtuse, abruptly narrowed to short petioles about one-fourth the length of the blades, entire or sometimes irregularly serrate-dentate. Cauline leaves 3 to 6, similar but smaller, 1-2 dm. long. Heads usually solitary, terminal, very large, 3.5-6 cm. broad, shallowly hemispherical. Outer phyllaries very large, ovate or lanceolate, unequal, broadest above the base, foliaceous, erect or spreading, acute or obtuse, equaling or usually much exceeding the disk- and ray-flowers; inner phyllaries similar but reduced. Disk-flowers pubescent on the lobes. Ray-flowers yellow, about 12, 3-5 cm. long, glabrous. Achenes 12-15 mm. long, pubescent above. Pappus coroniform, prolonged into several short, stout awns.

Type Locality.—"In California legit cl. Douglas." The original material was gathered in 1831, probably in the vicinity of San Francisco.

Distribution.—Open slopes, Sierra Nevada foothills in California from Eldorado County south to Mariposa County, and in the Coast ranges from Mendocino County south to San Luis Obispo County (map 4). March to May.

CALIFORNIA. ELDORADO CO.: near Camino, May 26, 1907, *Brandegee* (UC); Placerville, May, 1923, *King* (CA), April 28, 1943, *Robbins 1038* (WS). AMADOR CO.: Irishtown, 450 m. alt., April 26, 1895, New York Falls and Agric. Sta., 600 m. alt., April, 1892, May, 1894, May, 1895, *Hansen 171* (D, M, P, UC, US). CALAVERAS CO.: Mokelumne Hill, *Blaisdell* (CA)*[7]; Angel's Camp, April 11, 1923, *Eastwood 11662, 11663* (CA); between Murphy's and Angel's Camp, April 10, 1936, *Mason 11048* (UC). TUOLUMNE CO.: near French Flat, 420 m. alt., May 17, 1919, *Williamson 182* (CA, CLOKEY, D, NY, P, US). MARIPOSA CO.: Blochman's Ranch, April,

[7] Intermediate specimens or putatively hybrid series, *W. angustifolia* x *W. helenioides*, are indicated by an asterisk (*).

1915, *Eastwood 4341* (CA, US). SUTTER CO.: Marysville Buttes, 150 m. alt., April 18, 1917, April 22, 1926, *Ferris 675, 6379* (D, M, NY), April 7, 1928, *Vortriede* (CA); Butte Pass, Marysville Buttes region, April 20, 1891, *Jepson* (UC). COLUSA CO.: 3 mi. w. of Arbuckle, Arbuckle-Rumsey Road, April 14, 1917, *Ferris 601* (D, NY); near Stonyford, April 23, 1926, *Ferris 6581* (D); College City, 1905, *King* (UC). LAKE CO.: 6 mi. up grade, west side of Bartlett Mt., May 6, 1928, *Abrams 12433* (D)*; Blue Lakes, May 16, 1929, *Blankinship* (M); Weldon Valley, April, 1902, *Bowman 167* (D); Dashiell's, Mt. Sanhedrin, May 25, 1925, *Eastwood 12973, 12973a* (CA); above Summit Lake, 1560 m. alt., Mt. Sanhedrin, July, 1913, *Hall 9503* (UC); Jordan Park on road to Lower Lake, May 1, 1932, *Jussel* (CA); Bendmore Valley, 750 m. alt., April 27, 1934, *Wieslander 455* (UC). MENDOCINO CO.: Mt. Sanhedrin, 1680 m. alt., May 29, 1927, *Bacigalupi 1547* (D), June 7, 1893, *Blankinship* (UC); on way to Buck Rock Ridge, June 7, 1928, *Eastwood 15284* (CA); Potter Valley, 1895, *Purpus 1280* (UC). SOLANO CO.: near Vacaville, April 28, 1902, *Heller & Brown 5409* (D, G, M, NY, PA, US). NAPA CO.: Napa, April 24, 1924, *Jones* (P). CONTRA COSTA CO.: Mt. Diablo, May 26, 1921, *Abrams 8046* (D), April 5, 1901, *Chandler 943* (UC), April 5, 1901, *Hall 1732* (UC); Martinez, 1853-54, *Bigelow* (NY); foothills, Antioch, April 8, 1895, *Burtt-Davy 988* (UC); hills e. of St. Mary's College, May 14, 1933, *Howell 11286, 11287, 11288* (CA, P)*; without locality, April, 1892, *Michener & Bioletti* (WS). ALAMEDA CO.: Oakland and Oakland Hills, 1853-54, *Bigelow* (G), 1866, *Bolander 329, 6156* (G, NY, US), Mar. 13, 1931, *Constance 72* (PA), May 13, 1883, *Jones* (P), 1868-69, *Kellogg & Harford 425, 426* (G), May, 1881, *Rattan* (D), Mar. 2, 1932, *Schreiber 42* (UC); Grizzly Peak, April 23, 1893, *Burtt-Davy 120* (UC), Mar. 2, 1892, *Jepson* (UC, US); Piedmont, April 24, 1880, *ex herb. Congdon* (D); Redwood Ridge, Mar. 12, 1932, *Constance 403* (UC); Laundry Farm, Mar., 1894, *Eastwood* (G); Cedar (Cypress) Mt., 15 mi. from Livermore, May,1903, *Elmer 4634* (CA, D, M, NY, P, UC, UO, US); Moraga Valley, Mar. 30, 1917, *Evermann* (CA); Piedmont Hills, April 2, 1920, *Goodman* (CA); Arroyo Mocho, 9 mi. from Livermore, April 10, 1926, *Howell 1815* (CA); Claremont, near Berkeley, April 11, 1896, *Jepson 21449* (J, M); Alameda, Mar. 7, 1870, *Kellogg* (D), 1876, *Vasey* (G); Berkeley Hills, Feb. 9, 1917, *Mason 32* (D); Haywards, May 14, 1921, *Mason* (D). SAN MATEO CO.: Lake San Andreas, April 13, 1902, *Abrams 2334* (D, M, NY, P)*; Coal Mine Ridge, May 15, 1937, *Barry 143* (D). SANTA CLARA CO.: hills n. of Gilroy, April 13, 1903, *Baker 1944* (G, M, NY, P, US)*; Mt. Hamilton, April 20, 1902, *Baker 640* (CA, G, M, NY, P, UC, US, WS); near Campbell, May 7, 1907, *Heller 8509* (D, G, PA, US); 5.2 mi. e. s.e. of San Martin, 300 m. alt., April 11, 1938, *Hendrix 761* (UC); Mt. Copernicus, Mt. Hamilton Range, May 20, 1923, *Lang* (D); Kincaid Road, w. slope of Long Branch Creek, 540 m. alt., Mt. Hamilton Range, Mar. 30, 1934, *Sharsmith 695* (CA); Alum Rock Falls Road, w. side of Mt. Hamilton Range, 480 m. alt., Mar. 24, 1935, *Sharsmith 1517* (UC); top of Seeboy Ridge, 720 m. alt., Mt. Hamilton Range, May 3, 1935, *Sharsmith 1962* (UC); Arroyo Bayo, 540 m. alt., Mt. Hamilton Range, June 9, 1935, *Sharsmith 3343* (D, UC, WS); s.w. of San Antonio Valley on road to Arroyo Bayo, 570 m. alt., Mt. Hamilton Range, April 24, 1936, *Sharsmith 3622* (UC, WS); Canada Valley, near Gilroy, April 1, 1915, *Sheldon* (D); Los Buellos Hills, May 1, 4, 1907, Mar. 25, 30, 1908, *Smith* (PA, UC). SANTA CRUZ CO.: near Kings Creek, San Lorenzo Valley, May 7, 1893, *Dudley* (D). SAN BENITO CO.: Tres Pinos Creek near Bradford Mine, April 29, - May 1, 1921, *Abrams & Borthwick 7993a* (C, NY, P, US); Hickman's Ranch, Aromas, April 8, 1915, *Eastwood* (CA, US); San Benito, May 16, 1918, *Eastwood 6955* (CA, CLOKEY); Laguna Flats, 1200 m. alt., May 26, 1915, *Hall 9935* (UC); The Pinnacles, April 23, 1933, *Howell 11144* (CA, P); San Benito River 4 mi. s. of Tres Pinos, April 25, 1934, *Keck 2755* (D); Hernandez, May 30, 1903, *Lathrop* (D, US); along Tres Pinos Creek, 1 mi. s.e. of Emmet School, Panoche Pass Road, April 26, 1940, *Wiggins & Ferris 9346* (D, RM, WS); Pacheo Pass, April 13, 1938, *Winblad* (P). MONTEREY CO.: Tassajara Hot Springs, June, 1901, *Elmer 3154* (D, M); flat at w. base of Big Pinnacles, April 26, 1919, *Ferris 1728* (D). SAN LUIS OBISPO CO.: Estrella, Mar. 4, 1897, *ex herb. Jared* (UC); Atascadero, April 25, 1927, *Seitz* (CA); roadside 1½ mi. e. of Templeton, May 24, 1929, *Wiggins 3750* (D, UW).

Section 3. **Euwyethia** nom. nov.

"True Wyethia" A. Gray in Brewer, Watson & Gray, Bot. Calif. **1**:349. 1876, as section.

Basal leaves present, much larger than the cauline leaves, lanceolate in general outline. Phyllaries graduate, subequal, erect and appressed, not or only slightly exceeding the disk. Median vascular bundles of corolla lobes usually lacking. Achenes 6-10 mm. long.

Type Species: *Wyethia helianthoides* Nutt.

From a geological standpoint Euwyethia is probably the most recent section of the genus. The species, for the most part, occupy extensive areas; they have a broad range of habitats, and are apparently aggressive.

9. WYETHIA MOLLIS A. Gray

Wyethia mollis A. Gray in Proc. Am. Acad. **6**:544. 1865.

Plant densely tomentose, becoming glabrate in age. Basal leaves 2-4 dm. long, 0.7-1.5 dm. wide, lanceolate to oblong-ovate, pinnately veined, acute or obtuse at the apex, entire, tapering or abruptly narrowed to ample petioles one-half as long as to equaling the blades in length. Cauline leaves 3 to 5, similar but reduced upwards, the uppermost often very broad and truncate at the base, on short petioles. Heads 1 to 3. Involucre campanulate, 2-2.5 cm. wide. Outer phyllaries 4 to 6, herbaceous, lance-ovate, erect, equaling or slightly exceeding the disk. Disk-flowers pubescent on the lobes. Ray-flowers yellow, 6 to 12, about 3 cm. long, glabrous. Achenes 8-10 mm. long, pubescent above. Pappus crown with several long, rigid awns.

Type Locality.—Mono Lake and summit of Sonora Pass, 3,000 m. alt., Mono County, California.

Distribution.—Southern Cascade and Sierra Nevada ranges from Lake County, Oregon, south to Fresno County, California, and adjacent northwestern Nevada (map **6**). A record of the occurrence of this species in Lake County, California (Jepson, 1925, p. 1079), appears to be based on imperfect specimens of *W. helenioides*. May to July.

OREGON. LAKE CO.: Abert Rim, n. of Lakeview, 1725 m. alt., July 4, 1936, *Andrews* (UO); Fort Bidwell Road near California line, June 22, 1928, *Constance 9519* (UC, UO); 10 mi. n. of Lakeview, May 29, 1940, *Hitchcock 6746* (NY, P, UAC, UW); near Paisley, on Lakeview Road, June 21, 1927, *Leach & Leach* (UO); slopes of Crane Mt., near Lakeview, 1500-2400 m. alt., July 11, 1936, *Thompson 13231* (CA, NY, PA, UW, WS, WU). KLAMATH CO.: Swan Lake Valley, July, Aug., 1894, *Applegate* (D, PA); near Chiloquin, June 25, 1931, *Evans 287* (PA); between Merrill and Cottonwood, June, 1901, *Furlong, Greeley, Wilson, & Alexander* (UC); e. side of Klamath Marsh, 1515 m. alt., Aug. 15, 1894, *Leiberg 734* (D, G, M, NY, P, RM, UC, UO, US, WS); 2 mi. s. e. of Klamath Falls, July 12, 1920, *Peck 9442* (D, G, M, NY, PA, WU); 10 mi. n. of Bonanza, June 24, 1927, *Peck 15168* (D, UW, WU). COUNTY UNCERTAIN: "mountains n. of Cycan [Sycan] Valley and southward," Aug. 12, 1901, *Cusick 2749* (G, M, NY, P, RM, UC, UO, US).

NEVADA. WASHOE CO.: Hunters Creek Road, 7-8 mi. s. w. of Reno, 1950 m. alt., July 9, 1938, *Archer 6243* (M, NY); Coleman Valley, 1500 m. alt., July 29, 1896,

Coville & Leiberg 117 (US); 4½ mi. s. of Mt. Rose, 2490 m. alt., July 29, 1939, *Hitchcock & Martin 5551* (CLOKEY, NY, P, UAC, UW, WS); Third Creek, near Mt. Rose, 2550 m. alt., Aug. 3, 1938, *Howell 14051* (CA); Pyramid Lake, May 19, 1905, *Kennedy 1013* (NY, RM, UC, US); Martin Espil Ranch, Fortynine Mts., west margin of Long Valley, 1620 m. alt., May 25, 1939, *Train 2843* (NY). STOREY CO.: ¾ mi. s. w. of 5-mile House, n. w. of Virginia City, 1890 m. alt., July 29, 1938, *Adams 176* (UC); Mt. Davidson, near Virginia City, 1864, *Bloomer* (G, US). ORMSBY CO.: near Carson City, 1864, *Anderson 159* (G, US); King's Canyon, 1700-2000 m. alt., June 1, 1902, *Baker 937* (CA, G, M, NY, P, RM, UC, US, WS); foothills, Carson City, 1650 m. alt., May 31, 1897, *Jones* (D, M, UAC, US). DOUGLAS CO.: Glenbrook on Lake Tahoe, 1860 m. alt., July 6, 1919, *Tidestrom 10323* (US).

CALIFORNIA. MODOC CO.: Willow Ranch, e. side of Goose Lake Valley, June 25, 1929, *Applegate 5907* (D); Mill Creek Meadows, Warner Mts., July 31, 1932, *Applegate 7949* (D); June 22, 1893, *Baker* (NY, P, UC, US); above Parker Creek, 1650-2100 m. alt., Modoc National Forest, June 14, 1919, *Ferris & Duthie 121* (D), June 11, 1934, *Howell 11946* (CA); 15 mi. n. e. of Alturas, 1590 m. alt., May 27, 1940, *Hitchcock 6665* (CLOKEY, NY, UW, WS); Fort Bidwell, 1930, *Kelly 32* (CA); Fandango Pass, 900-1350 m. alt., June 2, 1940, *Willits 329* (D). SISKIYOU CO.: Bear Paw Cave, Lava Beds National Monument, June 8, 1935, *Applegate 9428* (D); Goosenest foothills, 1650 m. alt., May 10, 1910, *Butler 1336* (P). LASSEN CO.: Milford, June 26, 1892, *Brandegee* (UC); Doyle Sta., 1290 m. alt., May 29, 1911, *Eggleston 6717* (US); Sec. 10, T. 33 N., R. 7 E., 1710 m. alt., Lassen National Forest, July 12, 1933, *Fischer & Johnson 239* (UC); 5 mi. w. of Susanville, May 14, 1930, *Gillespie 9378* (D); 2 mi. w. of Fredonia Pass, between Susanville and Westwood, 1524 m. alt., June 25, 1935, *Keck & Clausen 3765* (D); between Grassy and Snag Lakes, Mt. Lassen National Park, Sept. 1, 1929, *Wolf 3777* (P, UC). SHASTA CO.: Montgomery Creek, 1923, *Bethel* (CA); near Fall River Mills, June 11, 1940, *Eastwood & Howell 7927* (CA)*[8], June, 1903, *Hall & Babcock 4251* (D, UC); 5 mi. e. of Burney Falls, May 23, 1940, *Hitchcock 6520* (CLOKEY, US, UW); near Prospect Peak, Lassen National Park, 1932, *Kramer* (CA). TEHAMA CO.: trail from Morgan's Springs to sulphur works, Lassen Butte region, Aug. 22-26, 1912, *Eastwood 1764* (CA, US); Mineral, 1500 m. alt., May 30, 1928, *Heller 14592* (D, M, NY, US). PLUMAS CO.: Butterfly Valley, June, 1876, *Austin 95* (UC); between Kelly's Camp and Drakesbad, June 21, 1929, *Applegate 5782* (D); Grassy Lake Meadow, 1860 m. alt., Gold Lake region, July 11, 1927, *Bacigalupi 1707* (D, NY, P); Greenville, May 4, 1920, *Clemens* (CA, NY); Portola, May 25, 1918, *Eastwood 7020* (CA); road from Reno to Chilcott, June 27, 1927, *Eastwood 14864* (CA); Sawmill Tom Creek, Little Grizzly R. S., Plumas National Forest, 1700 m. alt., July 30, 1927, *Eggleston 21554* (NY, US); near Mohawk, 1320 m. alt., June 11, 1938, *Grinnell & Grinnell 1094* (UC)*; Lake Independence, June 16, 1921, *Head* (CA); Prattville, 1350 m. alt., July 3, 1897, *Jones* (UAC); Mohawk Valley, May 30, 1889, *Lemmon* (UC); Breyes Flat, 12 mi. e. of Belden, 960 m. alt., June 8, 1939, *Rose 39261* (CA, M, NY)*; ¾ mi. s. w. of Beckwith, 1470 m. alt., May 21, 1935, *Sawyer 1* (UC). BUTTE CO.: Little Chico Canyon, May, 1899, *Austin 800* in part (US); Jonesville, 1600 m. alt., July 14, 1931, *Copeland 700* (CA, D, G, M, NY, P, RM, UAC, UC, UO). SIERRA CO.: Gold Lake, Sept. 7, 1921, *Applegate 3380* (D); Loyalton, June 29, 1918, *Eastwood 7900* (CA); Webber Lake, Aug. 6-12, 1927, *Haley* (CA); Lower Sardine Lake, 1800 m. alt., July, 1903, *Hall & Babcock 4486* (D, UC); Gold Lake, July 15, 1934, *Rose 34365* (UW). NEVADA CO.: lower end of Donner Lake, July 10, 1902, *Heller 6902* (D, G, M, NY, P, PA, RM, UC, US); Soda Springs, 2400 m. alt., July 23, 1881, *Jones 2482* (G, P, UAC); 1 mi. w. of Donner Summit, 1800 m. alt., July 23, 1939, *Maguire 17196* (RM, UAC); near Truckee, Aug., 1893, *Michener* (UC), June 21, 1884, *Sonne* (M, UC), July 16, 1901, *Williamson* (PA). PLACER CO.: Tahoe Tavern, 1875 m. alt., Aug. 12, 1927, *Blake 10195* (G); near Tahoe City, June 29, 1900, *Dudley* (D); Deer Park, June 15-19, 1912, *Eastwood 392* (CA, CLOKEY, G, NY, US); Cisco, June 26, 1910, *Hall 8716* (D, RM, UC, US), July

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[8] Intermediate specimens or putatively hybrid series, *W. angustifolia* x *W. mollis* are indicated by an asterisk (*).

26, 1908, *Walker 1446* (UC); ½ mi. n. e. of Mammoth Spring, 1710 m. alt., June 21, 1934, *Nordstrom 136* (UC); Lake Tahoe Camp, 1875 m. alt., June 17, 1930, *Randall* (UC). ELDORADO CO.: Tallac, 1950 m. alt., June, 1918, *Abrams 7324* (D); Camp Agassiz, July 21, to Aug. 15, 1906, *Eastwood 942* (CA, CLOKEY); Glen Alpine, July 21, to Aug. 15, 1906, *Eastwood 992* (CA); 150 m. above Phillips, 2250 m. alt., July 23, 1918, *Evans* (UC); near Echo Camp on the Lincoln Highway, 2190 m. alt., Aug. 10, 1916, *Heller 12518* (CA, CLOKEY, CO, D, G, M, NY, PA, US); St. Lawrence, July 7, 1882, *Jones* (P); near Fallen Leaf Lake, July 9, 1909, *Lathrop* (D); 8 mi. e. of Emerald Bay, Lake Tahoe, June 4, 1934, *Maguire, Maguire, & Maguire 15300* (UAC); Camp Sacramento, 1800-2400 m. alt., July-Aug., 1931, *Vortriede* (CA). AMADOR CO.: Ham's Sta., 1500 m. alt., May, 1895, *Hansen 1261* (CA, M). CALAVERAS CO.: vicinity of Silver Lake, Aug., 1927, *Duncan* (D); Salt Spring Reservoir, June, 1923, *Steinbeck* (CA). ALPINE CO.: Cable's Lakes, 2550 m. alt., June 22, 1892, *Hansen 421* (D, M, UC, US). TUOLUMNE CO.: Donohue Pass, July 23, 1935, *Christensen 2010* (UC); Lukens Lake, s. e. of White Wolf, 2520 m. alt., July 10, 1936, *Mason 11193* (UC); above ranger station, Tuolumne Meadows, 2520 m. alt., July 27, 1923, *Munz 7534* (P, RM); Hamlin Meadow, 8 mi. above Strawberry, July 4, 1925, *Steinbeck* (CA); Chipmunk Flats, about 5 mi. w. of Sonora Pass, July 6, 1935, *Wiggins 8073* (D, UW); Niagra Creek Public Camp, Sonora Pass Road, 1965 m. alt., July 24, 1938, *Wiggins 8979* (D, G, UC, UW). MONO CO.: Mt. Dana, Mono Lake, and the dry moraines of the e. slope of the Sierras, *Bolander 6024* (G); Mono Lake and summit of Sonora Pass, 3000 m. alt., 1863, *Brewer 1893* (G type); 2 mi. e. of Sonora Pass, 2850 m. alt., Aug. 10, 1938, *Constance 2451* (NY, RM, UAC, UC, WS); Rock Creek Canyon, 1800 m. alt., May 27, 1926, *Feridge 1433* (P); hills, 3 mi. from Mammoth Camp, July 19, 1918, *Ferris 1439* (D); northern part of Volcanic Tableland, June 26, 1925, *Peirson 6089* (P); w. end of Blue Lake, Virginia Lakes Basin, 2970 m. alt., July 16, 1934, *Peirson* (P); Robinson Creek, e. slope of Sierras near Bridgeport, 1950 m. alt., June 3, 1937, *Train 788* (CO, D, US); Tioga Pass, 3000 m. alt., July 25, 1938, *Winblad* (UAC); June Lake, July 5, 1929, *Wright* (P). MARIPOSA CO.: near Kenneyville, 1200-1350 m. alt., June 28, 1911, *Abrams 4544* (D); Nevada Falls, July, 1902, *Bacon* (D); Lake Tenaya, Aug. 18, 1890, *ex herb. Congdon* (D), June, 1902, *Hall & Babcock 3543* (D, UC); Snow Creek at rim of Yosemite Valley, 2100 m. alt., June 25, 1925, *Keck 163* (P); Pohono Trail, July 3, 1935, *Schreiber 1741* (UC); Merced Lake Trail, Aug. 2, 1935, *Schreiber 1935* (UC); Yosemite Valley and mountains, 1865, *Torrey 229b* (G, NY). MADERA CO.: Garnet Creek to San Joachin Mt., Aug. 8, 1941, *Howell 16817* (CA). FRESNO CO.: Pine Ridge, 1060 m. alt., June 15-25, 1900, *Hall & Chandler 406* (M, NY, P, UC, US); Big Creek region, July, 1915, *McDonald* (CA); n. shore of Huntington Lake, 2085 m. alt., June 8, 1931, *Peterson* (EWAN).

10. WYETHIA HELIANTHOIDES Nuttall

Wyethia helianthoides Nutt. in Jour. Acad. Phila. **7**:40. 1834.

Stem 3-5 dm. high, densely pilose at the summit, becoming glabrate at the base; foliage dull gray-green, pilose on both surfaces, ciliate on the margins. Basal leaves large, but narrower than those of *W. amplexicaulis*, 1-3 dm. long, 4-8 cm. wide, elliptic-lanceolate, entire or sometimes denticulate, acute at the apex, abruptly or gradually narrowed to the petiole, the lateral nerves ascending; petioles one-third the length of to equaling or exceeding the blades, sometimes winged. Cauline leaves reduced upward, sessile to amply petiolate, broadly lanceolate, tapered to the base or abruptly narrowed to the petiole, entire. Head solitary, terminal, about 3 cm. broad. Involucre hemispherical. Phyllaries numerous, loosely disposed, thin, herbaceous, subequal, erect, lance-linear, clothed especially on the margins with rather long, spreading

hairs. Disk-flowers glabrous. Ray-flowers 10 to 20, about 4 cm. long, sparsely pilose on the collar, cream-colored or white. Pales pilose on the margins and dorsal surface. Achenes 8-10 mm. long, pubescent above and on the margins below. Pappus shallow, laciniate, coroniform, often bearing one or more delicate bristle-like awns on the angles.

Type Locality.—"Camas Plain, Flathead River," Wyeth, 1833. Gray believed the location to be "in about lat. 47°, long. 114°," which would place it in Montana near the present site of Missoula. However, there is no evidence for the present occurrence of the species in that region. In view of the probability that Wyeth was in the vicinity of Missoula too early in the season (late April and early May) to find *Wyethia helianthoides* in blossom, it is likely that he collected the species later, probably in eastern Idaho.

Distribution.—Mountain meadows, Blue and Ochoco mountains of Oregon, to southern Idaho, northeastern Nevada, southwestern Montana and western Wyoming, at elevations of from 450 to 2,550 meters (map 5). Late May to July.

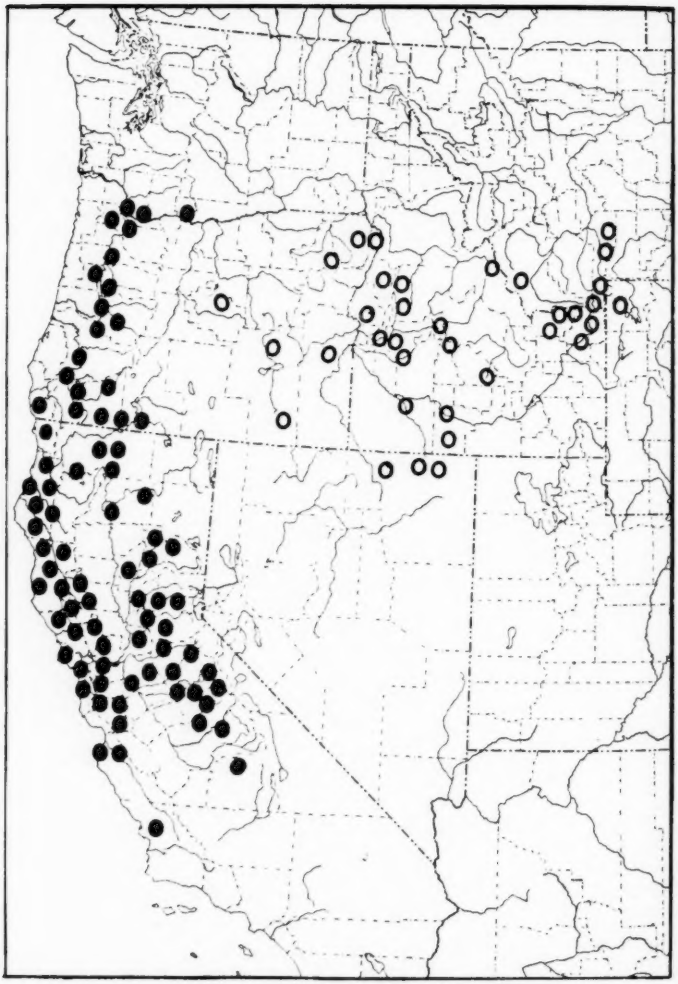
STATE UNCERTAIN: "Camas Plain, Flathead River," *Wyeth* (G isotype).

MONTANA. GALLATIN CO.: Fort Ellis, June 26, 1899, *Blankinship* (NY). June 8, 1883, *Scribner 103b* (G, PA); Upper Madison [River] near [Yellowstone] Park line, July 14, 1899, *Blankinship* (M); Bridger Canyon, July 25, 1902, *Jones* (UC)*[9]; Daly Creek, 2340 m. alt., June 24, 1933, *Swingle* (RM, UAC, UW). BEAVERHEAD CO.: Rattlesnake Creek, 2350 m. alt., *Tweedy 227* (NY, UC); head of Grasshopper Valley, July 13, 1880, *Watson 214* (G).

WYOMING. YELLOWSTONE NATIONAL PARK: Yellowstone Falls, July 8, 1899, *Blankinship* (RM); Yellowstone National Park, June, 1888, *Hall* (NY); Nez Perces Creek, July 30, 1899, *Nelson & Nelson 6274* (RM). TETON CO.: near bridge across Lizard Creek, 2100 m. alt., June 20, 1934, *Williams 1623* (CA, M, RM, UAC, WS).

IDAHO. VALLEY CO.: 1 mi. n. of Cascade, May 15, 1937, *Christ & Ward 7729* (CH); Payette Lake, 1500 m. alt., July 27, 1899, *Jones* (P). ADAMS CO.: New Meadows, May 29, 1937, *Constance 1857* (UC, WS), May 28, 1938, *Meyer 1470* (M); 5 mi. s. of New Meadows, June 9, 1936, *Rollins 1143* (NY). WASHINGTON CO.: Mann Creek, n. of Weiser, May 13, 1938, *Christ 9278* (CH). GEM CO.: Squaw Creek, 1050 m. alt., May 9, 1911, *Macbride 842* (D, G, M, NY, P, RM, UAC, UC, US, WS). BOISE CO.: Horseshoe Bend, June 15, 1937, *Murdock & Buffat* (WS); Arrow Rock Dam, June 1, 1933, *Train 105* (US). ELMORE CO.: 2 mi. above Willow Creek, 1260 m. alt., May 5, 1931, *Pearse 59* (UAC). OWYHEE CO.: Bruneau, May 24, 1934, *Christ 4538, 4539* (CH). FREMONT CO.: 1 mi. below Flat Rock Camp, s. of West Entrance, Yellowstone National Park, June 28, 1938, *Hitchcock, Rethke, & van Raadshooven 3854* (CA, D, G, UAC, UC, UW, WS); growing intimately with *13603, W. amplexicaulis*, in meadows 33 mi. n. of Warm Springs, June 12, 1936, *Maguire 13601, 13602**, *13603a** (CA, UAC, UC, UW); 32 mi. n. of Ashton, June 21, 1939, *Maguire 17087, a, b, c, d**, *17089, 17090** (UAC, UC, UW); 2 mi. w. of Rae, June 22, 1939, *Maguire 17125* (UAC, UC, UW); Continental Divide near Henry's Lake, June 21, 1899, *Nelson & Nelson 5483* (G, M, NY, RM, US). CLARK CO.: 7 mi. n. of Spencer, June 20, 1937, *Cronquist 575* (UAC); West Camas Creek above Kilgore, 1800 m. alt., June 20, 1938, *Cronquist & Davis 2068* (M); Camas Meadows, vicinity of Kilgore, June 20, 1938, *Cronquist 2148**, *2149**, *2150* (UAC), June 23, 1939, *Maguire 17160** (UAC, UC, UW); Spencer, June 12, 1916, *ex herb. Rust 497* (CA); Beaver Canyon, July 13, Aug. 13, 1880, *Watson 213, 214*, in part (G, PA, US). LEMHI CO.:

[9] Intermediate specimens or putatively hybrid series, *W. amplexicaulis* x *W. helianthoides*, are indicated by an asterisk (*).



Map 5. Distribution of some species of *Wyethia*, section Euwyethia: solid disks, *W. angustifolia*; open circles, *W. helianthoides*.

Bannock Pass, Medicine Lodge Creek, 2450 m. alt., June 5, 1928, *Eggleston & Bowers 22037* (M, NY, US). CUSTER CO.: Cape Horn, Stanley, June 23, 1940, *Christ 11331* (CH). BLAINE CO.: near Sawtooth, 2220-2550 m. alt., between Sawtooth and Alturas Lake, July 9-10, 1896, *Evermann 545, 594* (D, G, M, NY, US); 9 mi. n. of Carey, May 13, 1941, *Williams* (CLOKEY). GOODING CO.: 1000-Springs Valley, 690 m. alt., April 20, 1900, *Jones 6410* (D, G, M, NY, P, US). TWIN FALLS CO.: vicinity of Shoshone Ranger Station, June 14, 1938, *Cierisch 611* (UAC, UW). COUNTY UNCERTAIN: "Lake Fork of Snake River," and "Pierre's Hole," June 20, 22, 23, 1860, *Hayden* (M).

OREGON. WALLOWA CO.: meadows along creek 10 mi. n. of Enterprise, on lower ground than *W. amplexicaulis* with which it occurs and apparently hybridizes, and rarely intermixed with it, June 30, 1942, *Ownbey 2552, 2553a*, 2553b** (WS); summit of Imnaha-Snake Divide 23 mi. above Imnaha, July 11, 12, 1933, *Peck 17593* (D, NY, WU). UNION CO.: Hog Valley, 1200 m. alt., June 15, 1912, *Cusick 3731* (WS). WHEELER CO.: Crystal Creek, Sec. 6, T. 13 E., R. 20 N., 1566 m. alt., Ochoco National Forest, June 26, 1945, *Weber 2899*, 2900* (WS). CROOK CO.: near head of Ochoco Creek, June 9, 1930, *Applegate 6187* (D); Ochoco Mts., June 5, 1932, *Henderson 14213½* (CO, UC, UO, UW). MALHEUR CO.: Owyhee-Malheur Divide, 450-570 m. alt., May 30, 1896, *Leiberg 2164* (G, NY, P, UC, US). HARNEY CO.: Burns, May 16, June 3, 1927, *Henderson 8620* (CA, UO); Hoffman's Ranch, Steens Mts., June 9, 1927, *Leach 19710* (WU).

NEVADA. ELKO CO.: Jarbidge, Jack Creek Divide, 2550 m. alt., July 11, 1912, *Nelson & Macbride 2025* (G, M, NY, RM, US, UW); 4 mi. s. of Whiterock, 1800 m. alt., May 26, 1940, *Holmgren 553* (RM, UAC, UW, WS); 15 mi. w. of San Jacinto, 1800 m. alt., June 5, 1938, *Passey* (G, UAC).

11. WYETHIA ANGUSTIFOLIA (DC.) Nuttall

Wyethia angustifolia (DC.) Nutt. in Trans. Am. Phil. Soc. II. **7**:352. 1840.
Alarçonia (?) angustifolia DC., Prodr. **5**:537. 1836.
Helianthus longifolius Hook., Fl. Bor.-Am. **1**:313. 1834, not Pursh, 1814.
H. Hookerianus DC., Prodr. **5**:590. 1836.
Wyethia robusta Nutt. in Trans. Am. Phil. Soc. II. **7**:352. 1840.
W. foliosa Congdon in Erythea **7**:186. 1900.
W. angustifolia var. *foliosa* H. M. Hall in Univ. Cal. Publ. Bot. **4**:207. 1912.
W. angustifolia var. *solanensis* Jepson, Man. Fl. Pl. Calif., p. 1080. 1925.

Plant 1.5-6 dm. high, from almost scapose to tall and leafy, softly appressed-pubescent to hirsute and scabrous. Leaves very variable, the basal large, the cauline reduced upwards, linear-lanceolate to broadly ovate-lanceolate, 15-35 cm. long, 1-15 cm. wide, long-petiolate to sessile, tapered at both ends or sometimes the bases of the upper ones almost cordate, entire or sometimes irregularly serrate- or undulate-margined. Heads 1 to 3 (usually only one), 3-4 cm. wide, on long, slender peduncles. Involucre hemispherical. Phyllaries numerous, erect, lanceolate, usually slightly dilated above, equaling the disk, conspicuously ciliate on the margins. Disk-flowers pubescent or glabrate on the lobes. Ray-flowers 10 to 17, pubescent or glabrate on the tube. Achenes about 8 mm. long, minutely pubescent above. Pappus crown shallow, prolonged on the angles into from 1 to 4 pubescent or scabrous, filiform awns.

Type Locality.—Douglas' material was gathered "round Monterrey, Upper California," and represents the race inhabiting the San Francisco Bay region.

Distribution.—Southwestern Washington in and west of the Columbia Gorge, south through Oregon and California, west of the Cascade-Sierra Axis

to Tulare and San Luis Obispo counties, California, from sea level to 2,040 m. alt. (map 5).

WASHINGTON. KLICKITAT CO.: Columbia River [Bingen], June 9, Aug., 1881, *Suksdorf 129* (G, PA, UC, US, WS). CLARK CO.: Lacamas Creek, June 17, 1928, *English 1107* (PA, WS).

OREGON. CLACKAMAS CO.: Tualatin Prairie, July 5, 1882, *Henderson 73* (UO); Eagle Creek, June 15, 1925, *Suksdorf 3348* (WS); Estacada, June 11, 1927, *Thompson 2592* (D, UW). MULTNOMAH CO.: about Portland, June 3, 1880, *Henderson* (UO); Sauvies' Island, *Howell* (G); Linnton, June 25, 1910, *Suksdorf 1519* (WS). WASHINGTON CO.: Forest Grove, June 21, 1894, *Lloyd* (NY), May 27, 1926, *Thompson 695* (D, M). MARION CO.: Salem, May 29, 1921, *Nelson 3725* (G, PA), June 14, 1909, *Peck 7578* (WU). LINN CO.: near Brownsville, June 15, 1931, *Henderson 13611* (UO). BENTON CO.: Corvallis, May 31, 1892, *Mulford* (M, NY), June 25, 1898, *Kincaid* (WS), June 2, 1919, *Dykstra* (M). LANE CO.: 20 mi. from Eugene, May 9, June 23, 1932, *Henderson 14535* (CO, UC, UW); Eugene, June 25, 1915, *Nelson 355* (D); s. slope of Spencer's Butte, May 28, 1934, *Henderson 16429* (UO); Pacific Hwy. near Douglas Co. - Lane Co. boundary, 225 m. alt., June 10, 1926, *Ingram 2079* (UO); s. slope of Hardesty Mountain [T. 20 S., R. 1 E., about 9 mi. s. e. of Lowell], June 21, 1924, *Ingram 1549* (UO); Cottage Grove, June 15, 1916, *Peck 7511* (WU). DOUGLAS CO.: Roseburg Quadrangle, May 5, June 15, 26, 1914, *Cusick 3983, 4118, 4123, 4201* (WS); base of Coast Mts., near Melrose, July 2, 1914, *Cusick 4269* (WS); Yoncalla, June 14, 1936, *Eastwood & Howell 2851* (CA); bluffs of West Fork of Cow Creek at bridge 3 miles up, June 6, 1930, *Henderson 13325* (UO). KLAMATH CO.: Courtade Ranch, near head of Denny Creek, Cascade Mts., July 3, 1927, *Applegate 5143* (D); near Klamath Lake, June 25, 1927, *Leach* (UO); Keno, July 7, 1920, *Peck 9375* (D, G, M, NY, PA, WU); Klamath Bridge, Klamath Falls Hwy., June 21, 1927, *Peck 15108* (D, UW, WU); 8 mi. s. w. of Lake-of-Woods, July 5, 1931, *Peck 11692* (WU). JACKSON CO.: near Emigrant Creek, 3-6 mi. s. of Ashland, 660-720 m. alt., May 19, 1898, *Applegate 2217* (D, US, WS); Rancheree Creek, 840 m. alt., June 22, 1898, *Applegate 2520* (D, NY, US); Sykes Creek near Wimer, May 27, June 10, 1892, *Hammond 210* (M, NY, US); near Talent, May 17, 1930, *Henderson 12639* (UO); between Prospect and McLeod, June 30, 1939, *Hitchcock & Martin 5067* (NY, UW); Siskiyou Summit, June 23, 1929, *Kildale & Gillespie 8351* (D); near Woodville, June 28, 1909, *Peck 7579* (WU); Grizzly Peak, July 17, 1913, *Peck 7581* (WU); Long Prairie, 7 mi. e. of Pinehurst, June 21, 1927, *Peck 15083* (WU); 4 mi. w. of Prospect, May 28, 1924, *Sherwood 883* (PA, WU). JOSEPHINE CO.: s. of foot of Sexton Grade on Pacific Hwy., May 12, 1924, *Abrams & Benson 10428* (D, RM, UO); Applegate River near Provolt, June 12, 1927, *Applegate 5046* (D, WU); Deer Creek Valley, July 4-16, 1919, *Dale* (D, WU); Grants Pass, June 20, 1886, *Henderson 502* (NY), June 28, 1913, *Peck 7580* (WU), June 11, 1904, *Piper 5063* (G, US), May 12, 1912, *Prescott 5037* (G, WU); slopes of Mt. Grayback, 1200-1800 m. alt., June 27, 1936, *Thompson 12989* (NY, UW). CURRY CO.: Elmer Miller's Ranch, Pistol River, 150 m. alt., June 21, 1929, *Leach & Leach 2285* (UO); The Heads, Port Orford, June 20, 1919, *Peck 8442* (G, M, NY, PA).

CALIFORNIA. SISKIYOU CO.: Sisson, near Mt. Shasta, June 1-15, 1897, *Brown 345* (NY, PA, RM); near Hawkinsville, May 31, 1909, *Butler 755* (D, UC); foothills of Goosenest Mt., June 22, 1909, *Butler 951* (D, P, UC); near Yreka, May 20, 1910, *Butler 1372* (CA, D, M, P, RM, UC, US); Shasta Retreat, 1050 m. alt., July 10, 1911, *Condit* (UC); Scott River Valley, June 15, - July 15, 1899, *Gilbert* (UC); near Yreka, June 21, 1876, *Greene 876* (M, PA); South Fork of Salmon River near Big Flat, 1500 m. alt., July 23, 1937, *Howell 13342* (CA); Salmon River at Hawkins Bar, 150 m. alt., May 26, 1929, *Kildale 9206* (D); between Weed and Yreka, June 20, 1941, *Winblad* (CA). DEL NORTE CO.: Madrona Camp (road to Big Flat), 500 m. alt., July 5, 1938, *Van Deventer 124* (J); Gasquet, Aug., 1937, *Van Deventer 64* (J); Low Divide, July 1, 1937, *Van Deventer 71* (J). TRINITY CO.: Preacher Meadow, June 25, 1937, *Eastwood & Howell 4939* (CA); South Yollo Bolly, July 25, 1897

Jepson 21446 (J); Browns Creek, May 29, 1914, *Yates 375* (UC). HUMBOLDT CO.: Brannan Mt. near Willow Creek, June 15, 1918, *Abrams 7125* (D); Supply Creek, Hoopa Valley, June 21, 1899, *Burtt-Davy & Blasdale 5726* (UC); Klamath River, 420 m. alt., June, 1901, *Chandler 1494* (UC); Lookout Point, Look Prairie, Humboldt Redwood Park, 360 m. alt., May 29, 1934, *Constance 725* (J, WS); near Dinsmore's, June 23, 1937, *Eastwood & Howell 7488* (CA); Van Dusen, June 16, 1907, *Goddard 6123* (UC); Laribee Valley, 690 m. alt., June 27, 1926, *Kildale 2217* (D); Bug Creek, 780 m. alt., May 20, 1927, *Kildale 3205* (D); between Three Creeks and mouth of Willow Creek, 750 m. alt., July 6, 1911, *Tracy 3352* (UC); Alton, 30-90 m. alt., June 9, July 21, 1912, *Tracy 3657, 3755* (UC); bluff near Bucksport, 0-30 m. alt., June 10, 1913, *Tracy 4079* (UC); Hoopa Mt., on road w. from Hoopa Valley, 900 m. alt., June 6, 1926, *Tracy 7577* (UC); Upper Mattole Valley, 150 m. alt., July 24, 1927, *Tracy 8295* (UC); Bear River Ridge, July 27, 1930, *Tracy 8898* (J, UC); Horse Mt., 1410 m. alt., June 14, 1934, *Tracy 13217* (UC); French Camp Ridge, 1050 m. alt., Aug. 6, 1933, June 23, 1935, *Tracy 12937, 13988* (D, J, UC); n. w. slope of Buck Mt., 750 m. alt., June 20, 1913, June 17, 1936, *Tracy 4226, 14947* (J, UC, US); "Devil's Hole," Trinity Summit, 1650 m. alt., July 24, 1937, *Tracy 15524* (UC); 7 mi. s. of Ferndale and Capetown, Bear River Ridge, Mt. Glen, Aug. 29, 1927, *Wolf 1200* (D). LASSEN CO.: Big Valley Mts., June 11, 1940, *Eastwood & Howell 7985* (CA). SHASTA CO.: Burney, June 23, 1929, *Applegate 5860* (D); Fall River Mills, June 11, 1940, *Eastwood & Howell 7927* (CA)*[10]; Goose Valley, July 2, 1912, *Eastwood 824* (CA, G, NY, US); Fall River Springs, 1050 m. alt., June, 1903, *Hall & Babcock 4182* (UC); near Redding, May 27, 1905, *Heller 7877* (D, G, M, NY, PA, US). MENDOCINO CO.: Wolf Creek, July 8, 1916, *Abrams 5917* (NY); Fort Bragg, Aug. 8-16, 1912, *Eastwood 1598* (CA); Potter Valley, May 19, 1925, *Eastwood 12638* (CA, P); near Covelo, June 5, 1928, *Eastwood 15201* in part (CA)†[11]; near Glen Blair, May 22, 1936, *Eastwood & Howell 2683* (CA); near Bell Springs, June 21, 1937, *Eastwood & Howell 4600* (CA); near Cummings P. O., July 7, 1938, *Eastwood & Howell 6117* (CA); grade s. of Hopland, May 24, 1933, *Henderson 15246* (UO); Pieta, Russian River, May 17, 1943, *Jepson 20833, 20834***[12] (J); Mendocino, Aug. 2, 1882, *Pringle* (NY); near Comptche, June 23-29, 1906, *Walker 313* (UC); Round Valley, 417 m. alt., June 2, 1938, *Tracy 15765* (UC); between Laytonville and Willets, June 21, 1941, *Winblad* (CA). PLUMAS CO.: Prattville, 1350 m. alt., July 3, 1897, *Jones* (M, P, US); Indian Valley, Aug., 1883, *Lemmon* (UC); Breyes Flat, 12 mi. e. of Belden, 960 m. alt., June 8, 1939, *Rose 39261* (CA, M, NY).* BUTTE CO.: e. of Chico, May, 1896, *Austin 800* in part (M); Mt. Ida Ranch, 10 mi. e. of Oroville, May 25, 1915, *Heller 11900* (CA, CO, D, G, M). YUBA CO.: Smartsville, May 22, 1923, *Crambie* (CA); Browns Valley, 60 m. alt., May 28, 1940, *Rose 40382* (CA). LAKE CO.: 6 mi. up grade, west side of Bartlett Mt., May 6, 1928, *Abrams 12433* (D) ‡[13]; Kelseyville, April 26, 1923, June 8, 1924, *Blankinship* (CA, M); Snow Mt., June 21, *Brandegee* (D, UC); Dashiell's, Mt. Sanhedrin, May 22, 1925, *Eastwood 12870* (CA); foothills s. of Mt. Sanhedrin, midway between Potter Valley and Hullville, July 19, 1902, *Heller 5905* (CA, D, G, M, NY, P, PA, US); Coast Range, summit of the ridge w. of Leesville, 600 m. alt., May 10, 1919, *Heller 13129* (CA, D, G, NY, PA, US); Binkley Ranch, between Cobb Mt. and Adams Springs, June 30, 1933, *Jussel 321* (CA); 6 mi. n. of Lucerne, May 5, 1928, *Wolf 1934* (D). SONOMA CO.: Petrified Forest, June 5, 1915, *Eastwood 4580* (CA); 11 mi. n. of Santa Rosa, May 19, 1936, *Eastwood & Howell 2505* (CA); Skaggs Springs, June 3, 1915, *Hawver* (CA), May 1, 1892, *Michener & Bioletti* (WS); Sonoma Valley, 1865, *Torrey 229a* (G, NY, US). SOLANO CO.: Suisun,

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10 Intermediate specimens or putatively hybrid series, *W. angustifolia* x *W. mollis*, are indicated by an asterisk (*).

11 Intermediate specimens or putatively hybrid series, *W. angustifolia* x *W. longicaulis*, are indicated by a dagger (†).

12 Intermediate specimens or putatively hybrid series, *W. angustifolia* x *W. glabra*, are indicated by a double asterisk (**).

13 Intermediate specimens or putatively hybrid series, *W. angustifolia* x *W. helenioides*, are indicated by the double dagger (‡).

April 30, 1921, *Eastwood 10400* (CA); near the Montezuma School, May 14, 1892, *Jepson 21452* (J type of var. *solanensis*); Vallejo, April 23, 1914, *Jones 339* (G); near Vacaville, April 28, 1902, *Heller & Brown 5390* (D, NY, PA, US); Vanden Sta., May 12, 1928, *Heller 14554* (D, M, NY, US); Blue Rock Springs, May 21, 1933, *Howell 11301* (CA). NAPA CO.: Oakville, May 2, 1870, *Brannan* (D); Napa, April 24, 1924, *Jones* (D, P); Pope Valley, April 19, 1931, *Jussel* (CA). MARIN CO.: Ignacio, April 27, 1918, *Abrams 6890* (D); Tiburon, June, 1907, *Brandegee* (UC); Point Reyes, 1853-54, *Bigelow* (NY), April 20, 1940, *Cantelow* (P), May, 1906, *Eastwood* (CA), May 7, 1938, *Gould 378* (UC); Angel Island, April 2, 1898, *Burtt-Davy 4190* (UC); road to Muir Woods, April 8, 1913, *Condit* (UC); Sausalito, June 9, 1912, *Eastwood 295* (CA, CLOKEY); Olema, May 21, 1933, *Henderson 15288* (UO), April 17, 1868, *Kellogg & Harford 424* (NY); Pipeline Trail, April 5, 1925, *Howell 897* (CA); Kentfield, May 1, 1912, *Parsons* (CA). NEVADA CO.: halfway between Auburn and Grass Valley, May 28, 1926, *Bacigalupi 1502* (D); Nevada City, June 20-22, 1912, *Eastwood 574* (CA, NY, US); Kres, 840 m. alt., June 16, 1916, *Hall 10199* (UC); head of south Wolf Creek, 850 m. alt., June 8, 1916, *Hall & Essig 10176* (CA, D, G, M, NY, P, RM, UC, UO, US). PLACER CO.: Auburn, May, 1892, *ex herb. Ames* (G, US); Dutch Flat, July, 1900, *Cole* (UC); between Lincoln and Sheridan, May 22, 1921, *Eastwood 10586* (CA, G, US); 5 mi. n. of Lincoln, May 17, 1917, *Hall 11312* (UC); 1 mi. w. of Baxter, May 7, 1940, *Hitchcock 6324* (P, UW); Meier Ranch, ca. 6 mi. n. of Colfax, 750 m. alt., May 14, 1940, *Hitchcock 6391* (M, P, UAC, UW); Applegate, May 28, 1937, *Phelps* (CA). EL-DORADO CO.: Simpson's Ranch, Sweetwater Creek, May 28, 1907, *Brandegee* (UC); Sweetwater Creek, 2 mi. above its mouth, May 7, 1939, *Constance 2482* (NY, UC); Aukum, May 21, 1903, *Gross 110* (D); St. Lawrence, July 7, 1882, *Jones* (P); Coloma, May 16, 1928, *Vortriede* (CA). AMADOR CO.: Plymouth, May 29, 1903, *Gross 183* (D); Jackson Gate, 390 m. alt., April 7, 1895, *Hansen 1262* (D, M, US); Pine Grove, 750 m. alt., May 7, 1891, *Hansen 169* (CA, M); ½ mi. w. of Central House, 240 m. alt., April 27, 1936, *Nordstrom 761* (UC). CALAVERAS CO.: Mokelumne Hill, *Blaisdell* (CA)‡; near Murphy's, July 7, 1891, *Brandegee* (UC); road to Calaveras Grove, July 2, *Brandegee* (UC). TUOLUMNE CO.: Rosascos, Aug. 1906, *Eastwood* (CA); Mather, 1350 m. alt., July 16, 1923, *Munz 7351* (NY, P); on benches above s. end of Vernon Lake, just n. of Hetch-Hetchy Valley, 2040 m. alt., July 23, 1938, *Sharsmith 3668* (WS); Peoria Mt., 480 m. alt., May 7, 1919, *Williamson 165* (CA, D, NY, P, RM, US). MARIPOSA CO.: LeConte Memorial to Happy Isles, Yosemite Valley, 1200-1350 m. alt., June 27, 1911, *Abrams 4520* (CLOKEY, D, G, NY, P); Pate Valley, Yosemite National Park, Aug. 4, 1919, *Clemens* (CA); Tenaya Trail, Aug. 14, 1894, *ex herb. Congdon* (UC); Snow Creek, July 3, 1892, *ex herb. Congdon* (CA, D, NY); Crockers, Aug. 1, 1907, *Eastwood 1* (CA); Big Meadows, 1350 m. alt., June 7, 1911, *Hall 8884* (UC); vicinity of Hog Ranch, 1410 m. alt., July, 1902, *Hall & Babcock 3343* (UC, US); near Aspen Valley, July, 1902, *Hall & Babcock 3647* (UC); Wawona, 1200 m. alt., June 20, 1924, *Howell 430* (CA); Crane Flat, Aug. 15, 1872, *Redfield 3520* (M); above Coulterville, May, 1932, *Seale* (CA); Moss Creek drainage, old Coulterville Road, vicinity of Yosemite Valley, 1500 m. alt., Aug. 10, 1934, *Sharsmith 857* (WS). MADERA CO.: North Fork S. R. E. plots, North Fork, April 26, 1934, *Bacigalupi 2254* (D, UC); Soquel Mills, Aug. 11, 1899, *ex herb. Congdon* (J type of *W. foliosa*); Coarse Gold on Raymond Road, May 29, 1941, *Ferris & Bacigalupi 10386* (RM, WS); 5 mi. from Oakhurst on road to Ahwahnee, May 29, 1938, *Howell 13878* (CA). FRESNO CO.: Pine Ridge, 1530 m. alt., June 12-25, 1900, *Hall & Chandler 92* (D, M, NY, UC, US). TULARE CO.: between Badger and General Grant Park, July 9, 1936, *Winblad* (CA). SACRAMENTO CO.: East Sacramento, May 10, 1917, *Ramaley 11232* (CO, UC); 4 mi. s. e. of Folsom on road to Placerville, May 14, 1933, *Carter 327* (CA, D, EWAN, G, M, NY, P, RM, UAC, UC, UO, US). SAN JOACHIN CO.: Holden, May 18, 1895, *Burtt-Davy 1222* (UC); 3 mi. s. of Galt, ca. 15 m. alt., May 12, 1940, *Hitchcock 6357* (NY, UW, WS); Clements Road, April 17, 1930, *Stanford 1339* (CA, M, RM). CONTRA COSTA CO.: Walnut Creek, 1860-62, *Brewer 1003* (G, US); Richmond Annex, April 19, 1913, *Condit* (UC); Martinez, May 4, 1894, *Eastwood* (G); hills e. of St. Mary's College, May 14, 1933, *Howell 11286, 11287, 11288* (CA)‡; Mt. Diablo, *Maclean* (UC).

ALAMEDA CO.: Piedmont, Oakland, May 13, 1917, *Abrams 6457* (D); Oakland Hills, 1865, *Bolander 80* (G), 1866, *Kellogg* (G, US); dry, open places on summit of Redwood Ridge, Mar. 26, 1932, *Constance 522* (UC); Oakland, May 13, 1883, *Jones* (P); Little Grizzly, Berkeley Hills, May 28, 1933, *Howell 11381* (CA); Haywards, May 14, 1921, *Mason* (D); n. of Berkeley, April 28, 1928, *Stanford 928* (P); vicinity of Berkeley, May-June, 1906, *Walker 102* (PA, UC); Alameda, 1876, *Vasey* (G). SAN FRANCISCO CO.: Bay View Hills, May 14, 1920, *Eastwood* (CA); Presidio, May 15, 1933, *Eastwood* (CA); Twin Peaks, April 29, 1933, *Rose 33114* (CA, D, P, UC, UW); near San Francisco, *Bloomer, Andrews* (G), June, 1858, *Hayes 440* (NY), 1866, *Kellogg* (M). SAN MATEO CO.: Lake San Andreas, April 13, 1902, *Abrams 2334, 2335* (D, M, NY, P)‡; Crystal Springs Lake, April 4, 1902, *Baker 449* (CA, D, G, M, NY, P, RM, UC, US, WS), May, 1903, *Elmer 4790* (CA, D, M, NY, P, UC, UO, US, WS); e. end of Searsville Ridge, April 1, 1903, *Davis* (D); Los Francos Woods, April 9, 1932, *Demaree 8969* (M, NY); Millbrae, June 10, 1912, *Eastwood 332* (CA); between Millbrae and Lake San Andreas, April 30, 1933, *Eastwood* (CA, D, NY); hills w. of Millbrae, 90 m. alt., April 15, 1941, *Rose 41138* (M). SANTA CLARA CO.: Stanford University, April 25, 1902, *Abrams 2368* (D, M, NY, P); near Gilroy, April 9, 1934, *Jones* (P, UC); hills n. of Gilroy, Apr. 13, 1903, *Baker 1944* (G, M, NY, P, US)‡; Grand View, west side of Mt. Hamilton, 525 m. alt., May 20, 1934, *Sharsmith 1070* (UC); Los Buellos Hills, April 14, 1906, *Williamson* (PA). MONTEREY CO.: Salinas Valley, 1889, *ex herb. Abbott* (CA); Pacific Grove, May 9, 1903, *Heller 6706* (G, M, PA, US); road to Point Lobos from Carmel-by-the-Sea, April 17, 1910, *Randall* (D). SAN LUIS OBISPO CO.: near San Luis Obispo, 1905, *Roadhouse* (UC). COUNTY UNCERTAIN: "California," *Douglas* (G isotype).

Wyethia angustifolia displays a great range of variation between local populations, one extreme being an almost scapose, low-growing form somewhat localized in the San Francisco Bay area, the other a tall leafy form most well marked in collections from Oregon. However, the species does not appear to exhibit sufficient morphological or geographic discontinuity to warrant nomenclatural recognition of the various forms for which taxonomic status has been proposed.

12. WYETHIA LONGICAULIS A. Gray

Wyethia longicaulis A. Gray in Proc. Am. Acad. **19**:4. 1883.

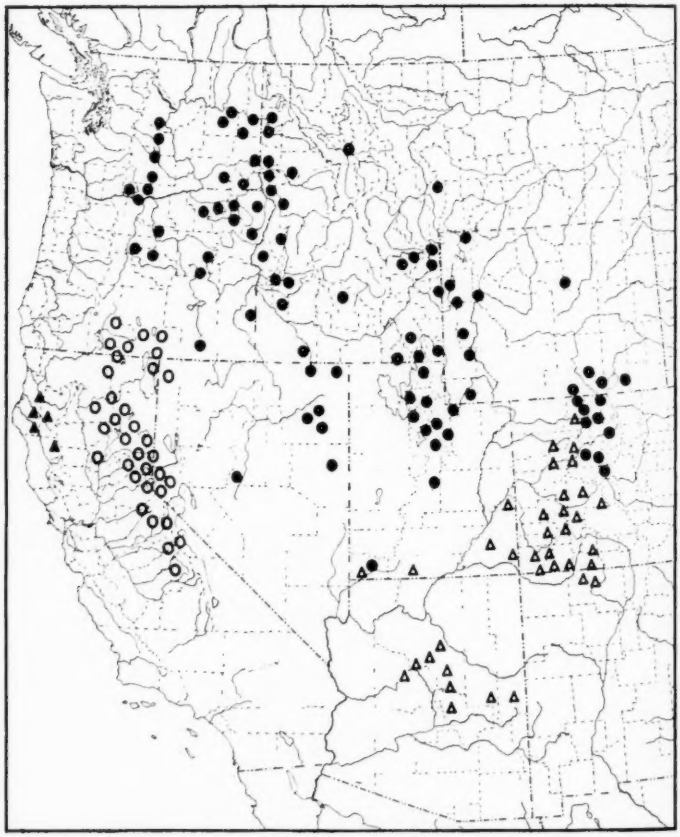
Plant slender, 3-6 dm. high, glabrous except for the resin-varnished foliar organs which are sparsely covered by an extremely fine, short pubescence. Basal leaves oblong-lanceolate, 15-40 cm. long, 1.5-4 cm. broad, light green, glossy, acute, entire or denticulate, sessile or tapering to a usually short petiole; lateral veins ascending. Stem leaves similar but reduced, sessile, the uppermost somewhat clasping. Heads 1 to 4, 1-3 cm. broad, on elongate, slender, dark-colored peduncles. Involucre broadly campanulate, that of the uppermost (largest) head hemispherical; outer phyllaries foliaceous, erect, lanceolate, broadest above the base, obtuse or acute, equaling or slightly exceeding the disk. Disk-flowers glabrous. Ray-flowers 6 to 15, yellow, resin-varnished dorsally. Achenes about 7 mm. long, with a very short, inconspicuous, lobed or lacerate coroniform pappus.

Type Locality.—Prairies of east Humboldt County, California.

Distribution.—Open slopes of the northern Coast ranges in eastern Humboldt, adjacent Trinity, and northeastern Mendocino counties, California (map 6). Late May to early July.

CALIFORNIA. TRINITY CO.: near summit of South Fork Mt., on road to Low Gap of Mad River, July 1, 1923, *Tracy 6506* (P). HUMBOLDT CO.: near Covelo, June 5, 1928, *Eastwood 15201* in part (CA)*14; Horse Mt., 900 m. alt., May 29, 1939, *Gould 841* (NY), June 9, 1926, *Kildale 2148* in part (D); Burr Valley on Buck Mt., 720 m. alt., June 17, 1936, *Harris, Tracy, & Yates 3404* (G, US); open ridges of Laribee Valley, May, 1930, *Parks 740* (P, UC, US); n. e. of Mad River, 1878, June, 1883, *Rattan* (D); prairies of e. Humboldt Co., 1883, *Rattan 22* (G type); near summit of

14 Intermediate specimen or putative hybrid, *W. angustifolia* x *W. longicaulis*.



Map 6. Distribution of some species of *Wyethia*, section Euwyethia: solid disks, *W. amplexicaulis;* open triangles, *W. arizonica;* solid triangles, *W. longicaulis;* open circles, *W. mollis*.

ridge between Van Duzen and Mad rivers, on Dinsmore's Ranch, 1050 m. alt., June 21, 1913, *Tracy 4254* (M, NY, US); near Horse Mt. Pass on Trinity Hwy., 870 m. alt., May 30, 1926, *Tracy 7517* (UC); Horse Mt., 1350 m. alt., June 20, 1926, *Tracy 7658* (UC); valley of South Yager Creek, 750 m. alt., June 26, 1932, *Tracy 10253* (UC); Grouse Mt., 1500 m. alt., July 7, 1938, *Tracy 16041* (D, NY, UC). MENDOCINO CO.: mountains e. of Round Valley, June, 1884, *Rattan 31* (D, G).

13. WYETHIA AMPLEXICAULIS (Nuttall) Nuttall

Espeletia amplexicaulis Nutt. in Jour. Acad. Phila. **7**:38. 1834.
Wyethia amplexicaulis Nutt. in Trans. Am. Phil. Soc. II. **7**:352. 1840.
Silphium (?) *laeve* Hook. in Lond. Jour. Bot. **6**: 244. 1847.
Wyethia lanceolata Howell, Fl. N. W. Am., p. 341. 1900.
W. amplexicaulis major Piper in Proc. Biol. Soc. Wash. **27**:98. 1914; *W. major* Anon., in index, *ibid.*, p. 234.
W. amplexicaulis subresinosa Piper, *ibid.*, p. 98; *W. subresinosa* Anon., in index, *ibid.*, p. 234.

Glabrous. Foliage deep green, leathery, glossy. Basal leaves very large, oblong-lanceolate, 20-40 cm. long or longer, 5-15 cm. broad, entire, sometimes denticulate or irregularly and shallowly dentate, pinnately veined, acute or acuminate at the apex and gradually narrowed to the short petiole, resin-varnished on both surfaces. Cauline leaves smaller, sessile, broadest near the base, usually clasping the stem, entire or denticulate. Heads large, several (occasionally solitary), the terminal head largest. Involucre hemispherical or campanulate (in the axillary heads), the outer phyllaries subequal, foliaceous, ovate-lanceolate, somewhat dilated above, acute or acuminate, longer than the rigid inner phyllaries and pales. Ray-flowers yellow, 6 to 16, 3-4 cm. long. Achenes 8-10 mm. long, glabrous. Pappus coroniform, sometimes prolonged into filiform awns on the angles of the achene.

Type Locality.—"About Flathead River. In moist lands," collected by Nathaniel J. Wyeth, 1833. Although this species occurs along the Clark Fork River (Wyeth's "Flathead River"), it seems unlikely that he could have collected it at the season of his visit (late April and May). Nuttall's collection from the second Wyeth Expedition, upon which he based his emended description under the present name, was from "The Rocky Mountains, toward the sources of the Platte," probably in eastern Idaho.

Distribution.—Moist draws and hillsides in open grasslands and woods at middle altitudes, southwestern Montana through Idaho, southeastern Washington and eastern Oregon, west to the Columbia Gorge, southward to southeastern Wyoming, adjacent Colorado, northern Utah, and northeastern Nevada (map 6). Outlying stations are known from Washington County, Utah, and Lander County, Nevada. *W. amplexicaulis* is the most widely distributed species in the genus, overlapping the distributional areas of *W. helianthoides*, *W. arizonica*, and *W. scabra*.

STATE UNCERTAIN: "Flathead River," *Wyeth*, photograph of the type specimen in the herbarium of the Academy of Natural Sciences of Philadelphia (P).

MONTANA. GALLATIN CO.: Sixteen-Mile Creek, July 1, 1902, *Jones* (UC); Bridger Canyon, July 25, 1902, *Jones* (UC)*15. MISSOULA CO.: Evaro, 1200 m. alt., July 13, 1909, *Jones* (D, NY, P).

IDAHO. FREMONT CO.: 33 mi. n. of Warm Springs, June 14, 1935, June 12, 1936, *Maguire 13602**, *13603*, *13603a** (UAC, UC); 32 mi. n. of Ashton, June 21, 1939, *Maguire 17087a, b, c, d,* 17088, 17090** (UAC); Henry's Lake, July 3, 1897, *Rydberg & Bessey 5176* (G, NY, PA, RM, UC, US). CLARK CO.: Spencer, 1800 m. alt., June 23, 1939, *Cronquist 1253* (M, UAC); Camas Meadows, vicinity of Kilgore, June 20, 1938, *Cronquist 2148, 2149* (UAC)*, June 23, 1939, *Maguire 17160* (UAC, UC)*. CUSTER CO.: Lost River Mts., Leatherman Pass, head of west fork Pahsimeroi River, Aug. 16, 1944, *Hitchcock & Muhlick 11206* (WS); Morse Creek, 5 mi. s.w. of Mt. Mogg, Aug. 19, 1944, *Hitchcock & Muhlick 11250* (WS). TETON CO.: Victor, July 11, 1901, *Merrill & Wilcox 1001* (G, NY, RM, US). BEAR LAKE CO.: Montpelier, May 20, 1910, *Macbride 214* (D, G, M, NY, RM, US, WS). BANNOCK CO.: City Creek above Pocatello, May 29, 1934, *Davis* (RM). ONEIDA CO.: Malad Valley, *Coulter 359* (PA). CASSIA CO.: Deadline Ridge, Minidoka National Forest, July 2, 1938, *Gierisch 688* (UAC). BLAINE CO.: Hailey, 1910, *Woods 330* (RM). KOOTENAI CO.: Coeur d'Alene, Aug., 1912, *ex herb. Rust 101* (US); 5 mi. n.e. of Worley, April 25, 1926, *St. John, Gessel, Jones, Rideout, & Woods 4238* (WS). BENEWAH CO.: Plummer, May 12, 1934, *Christ 3888* (CH). LATAH CO.: Moscow, May, 1900, *Abrams 594* (D, P, UC); Potlatch, May 12, 1934, *Christ 3931* (CH). NEZ PERCE CO.: top of hill, Culdesac, May 13, 1934, *Christ 4078* (CH); vicinity of Lake Waha, 600 to 1050 m. alt., June 19, 1896, *Heller & Heller 3263* (CA, D, M, NY, PA, UC, US); Craig Mts., Lake Waha, May 25, 1892, *Sandberg, MacDougal, & Heller 247* (CA, G, NY, P, US). CLEARWATER CO.: top of grade, Greer, May 30, 1937, *Christ 7437* (CH). LEWIS CO.: Winchester, June 8, 1929, *Phelps* (CA). IDAHO CO.: Whitebird Summit, June 15, 1941, *Davis 3215* (WS). ADAMS CO.: near New Meadows, *Teape 3060* (CH). WASHINGTON CO.: Middle Valley [Midvale], 690 m. alt., July 8, 1889, *Jones 6490* (D, M, NY, P, US). BOISE CO.: Spring Valley, Horseshoe Bend, May 20, 1935, *Tucker 410* (CH). GEM CO.: Squaw Creek, 1050 m. alt., May 9, 1911, *Nelson & Macbride 843* (RM). ADA CO.: Owyhee, June 23, 1930, *Jones 25091* (D, M, P). OWYHEE CO.: rim above Bruneau River Canyon near the Idaho-Nevada line, 1830 m. alt., June 26, 1937, *Christ 7975* (CH). COUNTY UNCERTAIN: moist ground, s.w. corner of Big Camas Prairie, 1500 m. alt., July 13, 1895, *Henderson 3035* (US); "Clearwater, Oregon," [possibly near Lapwai, Nez Perce Co.], *Spalding* (G, PA).

WASHINGTON. SPOKANE CO.: Spokane, May 31, 1892, *Henderson* (M); bench above Bonnie Lake, May 30, 1923, *St. John, Pickett, & Warren 3165* (WS). LINCOLN CO.: Davenport, 750 m. alt., May 20, 1905, *Jones* (P); s. side of Spokane River, 10 mi. above its mouth, 300 m. alt., May 21, 1940, *Rogers 487* (CLOKEY, WS). WHITMAN CO.: Kamiak Mt., June 23, 1936, *Eastwood & Howell 3112* (CA); Pullman, July 3, 1896, *Elmer 130* (M, NY, P, US); s. bank of Palouse River w. of Colfax, May 21, 1922, *Parker 396* (WS); Pullman, June 20, 1893, *Piper 1595* (G, M, NY, PA, UW, WS). GARFIELD CO.: Powell Camp, T. 9 N., R. 42 E., 1200 m. alt., near Clearwater R. S., Blue Mts., June 14, 1936, *Constance & Clements 1769* (WS). COLUMBIA CO.: Poverty Flat, T. 7 N., R. 41 E., July 16, 1913, *Darlington 94* (WS); Robinson Fork, Touchet River, May 31, 1925, *St. John, Davison, & Scheibe 6996* (WS); Wildcat Spring, T. 7 N., R. 40 E., July 6, 1927, *St. John & Smith 8325* (WS). WALLA WALLA CO.: Waitsburg, May 15, 1897, *Horner* (G). CHELAN CO.: Leavenworth, May 17, 1918, *Otis 679* (CA); Peshastin, 425 m. alt., July 21, 1893, *Sandberg & Leiberg 532* (CA, G, M, NY, UC, UO, US, WS); Tumwater Mt., 600 m. alt., May 12, 1934, *Thompson 10454* (M, NY, UW). KITTITAS CO.: near Liberty, June 24, 1931, *Thompson 6886* (D, EWAN, G, M, PA, UW); near Virden, June 8, 1935, *Thompson 11615* (D, M, NY, P, PA, UW); Cle Elum, May 26, 1897, *Whited 407* (US). YAKIMA CO.: Simcoe Mts., June, 1881, *Howell* (P); Cleman Mountain, 900 m. alt., May 27, 1940, *Thompson 14598* (M, NY, UW, WS). KLICKITAT CO.: Klickitat Hills,

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15 Intermediate specimens or putatively hybrid series, *W. amplexicaulis* x *W. helianthoides*, are indicated by an asterisk (*).

May 17, 1891, *Gorman* (UO), May, 1894, *Howell 1537* (UC); Bickleton, June 2, 1927, *Gotfredson* (P); Klickitat, June, 1881, *Howell 157* (US); White Salmon [now Bingen], 1878, *Suksdorf* (G); on the mountain near Bingen, June 27, 1906, *Suksdorf 5681* (WS); Falcon Valley, June 22, 1881, *Suksdorf 130* (D, PA, UC, US, WS).

OREGON. WALLOWA CO.: along creek 10 mi. n. of Enterprise; on higher ground than *W. helianthoides* with which it occurs and apparently hybridizes, and rarely intermixed with it, June 30, 1942, *Ownbey 2551, 2553a*, 2553b** (WS). BAKER CO.: Mormon Basin, 1200 m. alt., June 17, 1913, *Cusick 3861* (WS type of *W. amplexicaulis major*). UNION CO.: Hog Valley, 1200 m. alt., June, July, 1912, *Cusick 3728a, 3729* (type of *W. Cusickii*), *3730, 3730a, 3730b, 3731, 3738* (type of *W. amplexicaulis subresinosa*) (WS)*; La Grande, July 30, 1910, *Peck 7577* (WU); 3 mi. s. of Elgin, May 22, 1923, *Sherwood 297* (WU); Hot Lake fault scarp 10 mi. from La Grande, 900 m. alt., May 30, 1940, *Stevenson* (UO). UMATILLA CO.: La Zinka's Ranch, about 20 mi. n. of Ukiah, 1000 m. alt., June 23, 24, 1916, *Eggleston 12709* (US); Meacham, July 25, 1915, *Peck 7575* (WU); Pilot Rock, July, 1902, *Griffiths & Hunter 35* (NY, US). WASCO CO.: near The Dalles, May, 1895, April, 1896, *Howell* (UO). GRANT CO.: headwaters of Graham Creek near Blue Mt. Hot Springs, Strawberry Mts., July 4, 1919, *Ferris & Duthie 871* (D); Upper Silvies River, s. side of Blue Mts., June 13, 1927, *Henderson 8621* (CA, UO). WHEELER CO.: summit of grade out of Fossil, June 4, 1932, *Henderson 14507* (CO, UC, UW); Crystal Creek, S. 6, T. 13 S., R. 20 E., Ochoco National Forest, June 26, 1945, *Weber 2899*, 2901* (WS). CROOK CO.: Grizzly Butte, 1090 m. alt., June 19, 1894, *Leiberg 288* (G, NY, UC, UO, US); Ochoco R. S., June 21, 1932, *Peck 17028* (WU). MALHEUR CO.: Rockville, May 7, 1940, *Peck 20626* (WU). HARNEY CO.: Steen's Mts., May 29, June 1, 1885, *Howell* (US, UW); top of Steen's Mts., 5 mi. s. of Wild Horse Creek, 2200 m., alt., June 29, 1925, *Peck 14068* (D, WU). COUNTY UNCERTAIN: "Blue Mts. of Oregon," May 21, 1885, *Howell 445* (UO type of *W. lanceolata*).

WYOMING. JOHNSON CO.: head of Middle Fork of Powder River, July 19, 1901, *Goodding 329* (D, G, M, NY, P, RM, US). YELLOWSTONE NATIONAL PARK: Soda Butte, July 14, 1899, *Nelson & Nelson 5832* (M, RM). TETON CO.: Fish Creek, 1800 m. alt., July, 1897, *Tweedy 506* (NY); Camp Davis, Hoback River, June 22, 1940, *Wehmeyer, Martin, & Loveland 5164* (M); along Cottonwood Creek, Grand Teton National Park, June 13, 1934, *Williams 1612* (CA, M, RM, UAC, WS). FREMONT CO.: Union Pass Hills, Aug. 11, 1894, *Nelson 2904* [*816*] (RM). SUBLETTE CO.: 20 mi. w. of Big Piney, July 11, 1922, *Payson & Payson 2660* (RM). ALBANY CO.: hills e. of Laramie, June 21, 1891, *Buffum 476* (RM); University of Wyoming Summer Camp, Medicine Bow Mts., 1930, *Wann* (UAC). CARBON CO.: Elk Mt., June 16, 1899, *Little & Stanton 163* (M, NY); Indian Grove Mts., July 18, 1898, *Nelson 4896* (P, RM); near Sandstone R. S., Medicine Bow Mts., July 14, 1933, *Porter 1366* (M); Copperton, 2600 m. alt., June 25, 1901, *Tweedy 4013* (NY, US). LINCOLN CO.: La Barge, June 18, 1894, *Stevenson 183* (US). UINTA CO.: Fort Bridger, July 8, 1873, *Porter 3517* (NY, M, PA, US). COUNTY UNCERTAIN: "Black Hills," June, 1893, *Nelson* (UC).

COLORADO. JACKSON CO.: Arapahoe Pass, 3000 m. alt., July 21, 1891, *Crandall* (US); Camp Creek, July 6, 1903, *Goodding 1453* (D, G, NY, PA, RM, UC, US); Spicer, July 11, 1903, *Goodding 1532* (CO, M, NY, RM, US); North Park, July 14, 1896, *Osterhout 959* (RM); King's Canyon, 2700 m. alt., June 25, 1925, *Payson & Payson 4279* (RM). ROUTT CO.: Rabbit Ears Pass, 2850 m. alt., July 20, 1894, *Baker* (P); Egeria Park, July 15, 1896, *Biltmore Herbarium 5514a* (US); Continental Divide, 2700 m. alt., July 19, 1894, *Crandall* (NY, US); Elk River, July 24, 1903, *Goodding 1664* (CO, G, M, RM, US)†[16]; Little Columbine Lake, 2670 m. alt., July 7, 1933, *Johnson 154* (CO), Aug. 12, 1938, *Ramaley & Ewan 16716* (CO); Steamboat Springs, July 11, 1913, *Osterhout 7185* (RM); divide, Steamboat Springs Road, July 31, 1898, *Shear & Bessey 3940* (NY); Honnold, July 1, 1901, *Tweedy 4014* (NY, US). GRAND CO.: Middle Park, July, 1864, *Parry* (G, M). EAGLE CO.: Minturn,

[16] Intermediate specimens or putatively hybrid series, *W. amplexicaulis* x *W. arizonica*, are indicated by a dagger (†).

June 5, 1902, *Osterhout 2573* (RM); Eagle, June 25, 1939, *Zobel* (CA). LAKE CO.: near Leadville, *Schedin & Schedin* (RM).

UTAH. CACHE CO.: mouth of Pine Canyon, 1560 m. alt., May 20, 1932, *Burke 3153* (M, UAC); 2 mi. w. of Logan on Mendon Road, 1350 m. alt., May 20, 1932, *Maguire 3856* (UAC); 1 mi. below White Pine Lake, 2590 m. alt., Mt. Naomi region, Bear River Range, July 26, 1936, *Maguire, Hobson, & Maguire 14306* (UAC, UC, UW). BOXELDER CO.: Blue Springs Hills, near Blue Creek P. O., June 24, 1933, *Applegate 8670* (D); Boxelder Canyon, Brigham, June 5, 1910, *Zundel 215* (D, NY). WEBER CO.: Ogden, July 1, 1880, *Engelmann* (M); South Weber, May 31, 1917, *Jones 515* (G). MORGAN CO.: Peterson Canyon, Peterson, July 19, 1902, *Pammel & Blackwood 3772* (CA, G, M). SUMMIT CO.: right-hand fork of Provo River, July 12, 1938, *Garrett 7732* (D); Goodman Ranch near La Motte Peak, July 2, 1926, *Payson & Payson 4854* (D, G, M, NY, P, PA, RM, UC, US). SALT LAKE CO.: Red Butte Canyon, June 12, 1906, *Garrett 1774* (US); Alta, July 20, 1879, *Jones* (P); City Creek Canyon, 1800 m. alt., June 3, 1880, *Jones 1391* (D, G, NY, P, UAC); Oquirrh Mts., 2100 m. alt., Aug. 16, 1895, *Jones* (M, P); Parley's Park, 1800 m. alt., June, 1869, *Watson 594* (G, NY, US). WASATCH CO.: Midway, June 15, 1933, *Eastwood & Howell 509* (CA); Horse Creek, s. w. of Strawberry Reservoir, 2310 m. alt., June 18, 1935, *Graham 9254* (M); Daniel's Canyon, Strawberry Valley near East Portal, 2400 m. alt., June 10, 1938, *Harrison & Harrison 8716* (UAC). UTAH CO.: Mt. Timpanogos, Wasatch Mts., June 15, 1933, *Eastwood & Howell 475* (CA). SAN PETE CO.: Ephraim Canyon, Wasatch Mts., 2400 m. alt., Aug. 19, 1908, *Tidestrom 1750* (US); mountains e. of Gunnison, 2700 m. alt., Aug. 29, 1875, *Ward 666* (G, US). WASHINGTON CO.: vicinity of Leeds, June 10, 1937, *Deming 48* (UAC).

NEVADA. ELKO CO.: "Diamond A" Ranch, vicinity of Jarbidge, 1800 m. alt., spring, 1939, *Agee & Jacobsen* (UAC); Clover Mts., July 26, 1893, *Greene* (UC); Star Canyon s. e. of Deeth, 1710 m. alt., July 10, 1912, *Heller 10578* (CA, G, M, NY, US); vicinity of Gold Creek, Aug. 7, 1913, *Hitchcock 1135* (US); e. side of Elk Mt., Bull Camp, Humboldt National Forest, June 11, 1939, *Maguire 17006* (UAC, UC); 15 mi. s. of Secret on Ruby Road, 1830 m. alt., May 27, 1937, *Nichols & Lund 61* (M); mouth of Thomas Canyon, near La Moille Creek, Ruby Mts., 2250 m. alt., July 16-19, 1938, *Rollins & Chambers* 2561 (G); 76 Creek Divide [15 mi. s. w. of Jarbidge], Jarbidge Mts., Aug. 2, 1937, *Train 625* (NY). WHITE PINE CO.: Aurum, Aug. 20, 1893, *Jones* (P); Muncy [s. e. of Aurum on e. side of Shell Creek Range], July 6, 1891, *Jones* (P). LANDER CO.: Kingston Canyon and Birch Creek, 2250-2280 m. alt., Toiyabe Forest, July 30, 1913, *Hitchcock 896* (US).

14. WYETHIA ARIZONICA A. Gray

Wyethia arizonica A. Gray in Proc. Am. Acad. 8:655. 1873.

Similar to *W. amplexicaulis*, but densely hirsute-pubescent, becoming scabrous, or sometimes glabrate, the leaves narrower and smaller, with slender petioles, only the uppermost cauline leaves sessile or somewhat clasping. Disk-flowers pubescent on the lobes. Ray-flowers yellow, dorsally hirsute.

Type Locality.—"In pine woods and bottoms, Bear Springs, n. Ariz.," 1869, *Edward Palmer*. Bear Springs is about 4 miles northeast of the present site of Flagstaff, in Coconino County, Arizona, and was probably a point in the itinerary of Palmer's ascent of San Francisco Peak (McVaugh, 1943).

Distribution.—Dry hills and mountain slopes, western Colorado and adjacent Utah, Arizona, and New Mexico (map 6). June and July.

COLORADO. ROUTT CO.: Elk River, July 24, 1903, *Goodding 1164* (CO, G, M, RM, US)*[17]; Steamboat Springs, July 11, 1913, *Osterhout 7184* (RM). RIO BLANCO CO.:

17 Intermediate specimens or putatively hybrid series, *W. amplexicaulis* x *W. arizonica*, are indicated by an asterisk (*).

15 mi. s. of Meeker, July 22, 1935, *Maguire & Piranian 12896* (UAC). EAGLE CO.: Wolcott, June 21, 1900, *Osterhout 2115* (G, P, RM). GARFIELD CO.: hills s. of Rifle, June 25, 1900, *Osterhout 2155* (NY, P, RM); Glenwood Springs, 2400 m. alt., June 18, 1893, *Saunders 300* (US). GUNNISON CO.: Roger's, Aug. 14, 1901, *Baker 793* (G, M, NY, P, RM, UC, US)†[18]; Punena Creek near Mt. Ouray, 2700 m. alt., Aug., 1877, *Brandegee 11347* (M, UC); Waunita Springs, June, 1887, *Eastwood* (CO); vicinity of Mt. Carbon, 2730 m. alt., June 27, 1910, *Eggleston 5760* (US)†. MESA CO.: Tongue Creek, Mesa Grande, 2400 m. alt., July, 1892, *Purpus 266* (UC). DELTA CO.: near Crawford, 1950 m. alt., April 26, 1902, *Warren 1004* (US)†. MONTROSE CO.: Cerro Summit, 2400 m. alt., June 7, 1901, *Baker 61* (D, G, M, NY, P, RM, UC, US, WS); Uncompahgre Divide, 1950 m. alt., June 4, 1914, *Payson 397* (G, M, RM)†; Quaking Aspen Basin, Roubideaux Creek, July 19, 1908, *Tidestrom 1530* (US). OURAY CO.: Ridgeway, 2400 m. alt., June, 1895, *Tweedy 325* (US). SAN MIGUEL CO.: Iron Springs Mesa, 2250 m. alt., Aug. 21, 1912, *Walker 528* (G, RM, US, WS). MINERAL CO.: n. of Pagosa Springs, 2250 m. alt., May 28, 1934, *McKelvey 4715* (G)†. ARCHULETA CO.: Pagosa Springs, 2270 m. alt., June 30, 1921, *Bethel, Willey, & Clokey 4367* (CLOKEY, RM)†; Chimney Rock trail via Devil Creek, 2070 m. alt., Piedra, June 21, 1924, *Schmoll 1217* (CO, RM); Pagosa Springs, 2100 m. alt., May 27, 1883, *Smith 56* (PA)†; Square Top Ranger Station, San Juan Forest near Pagosa Springs, June 19, 1926, *Taylor* (CA)†. LA PLATA CO.: Los Pinos (Bayfield), May 20, 1899, *Baker 732* (M, NY, P, US); Rio Los Pinos, June, 1875, *Brandegee 1080, 4427* (M, PA, UC)†; Durango, May 21, 1916, *Eastwood 5348* (CA, G); Mancos to Durango Hwy., 13 mi. from Mancos, July 14, 1924, *Schmoll 1222, 1522* (CLOKEY, CO, RM, US); between Mancos and Durango, 2100 m. alt., May 25, 1934, *Stone 497* (NY)†. MONTEZUMA CO.: Chicken Creek w. of Mt. Hesperus, 2400 m. alt., July 7, 1898, *Baker, Earle, & Tracy 645* (G, M, NY, P, RM, US); Dolores, 2100 m. alt., June 18, 1892, *Crandall 310* (NY, US); crossing La Plata Mts., May 25, 1934, *McKelvey 4663* (G)†; Mancos, 2100 m. alt., May 27, to June 8, 1901, *Vreeland 855* (NY); Mesa Verde National Park, July 2, 1935, *Zobel* (CA, M).

UTAH. GRAND CO.: Moab, Aug. 30, 1891, *Jones* (P); 1 mi. s. of Warner R. S., 2790 m. alt., July 9, 1933, *Maguire, Richards, Maguire, & Hammond 17980* (UAC); w. slope of La Sal Mts., 660-900 m. alt., July 6, 1911, *Rydberg & Garrett 8608* (NY, US); Horse Gulch and vicinity, La Sal Mts., 900-960 m. alt., July 15, 1911, *Rydberg & Garrett 8947* (NY). SAN JUAN CO.: slopes of Elk Ridge, west rim, Abajo Mts., 2400 m. alt., June 23, 1932, *Maguire & Redd 2174* (UAC); Geyser Canyon, 2700 m. alt., July 19, 1912, *Walker 317* (D, G, M, NY, P, RM, US). KANE CO.: Sink Valley, June 21, 1890, *Jones* (D, M, P, UC, UO, US)†. WASHINGTON CO.: Apex Mine, 720 m. alt., April 22, 1931, *Cottam 4725* (UAC).

NEW MEXICO. RIO ARRIBA CO.: Wirt's Lookout, Jicarilla Apache Reservation, June 2, 1932, *Castetter 2077* (RM); pass s. e. of Tierra Amarilla, 2370 m. alt., April 18, to May 25, 1911, *Eggleston 6516* (US); vicinity of Brazos Canyon, Aug. 31, 1914, *Standley & Bollman 10977* (US).

ARIZONA. APACHE CO.: Willow Spring, 2220 m. alt., July, 1890, *Palmer 543* (G, US), July, 1874, *Rothrock 222* (G, NY, US). NAVAJO CO.: 10 mi. w. of McNary, White Mts., 2160 m. alt., June 23, 1930, *Goodman & Hitchcock 1320* (M, NY, RM); Lakeside, June 13, 1928, *Harrison 5530* (US). COCONINO CO.: Mogollon Mts., 2100 m. alt., *Collom 231* (M, NY); Flagstaff to Oak Creek, 2100 m. alt., July 29, 1935, *Kearney & Peebles 12201* (US); 6 mi. s. of Williams, 2190 m. alt., July 16, 1938, *Kearney & Peebles 14002* (UC); Flagstaff, Aug. 13, 1884, *Jones* (P); Crater Butte, e. of San Francisco Peaks, June 16, 1887, *Mearns 24* (NY); Baker's Butte, Mogollon Mts., July 13, 1887, *Mearns 116* (NY); Bear Springs, 1869, *Palmer* (G type); San Francisco Mts., July 10, 1892, *Toumey* (D); near Mormon Lake, July 17, 1892, *Toumey 679* (US). YAVAPAI CO.: Clark's Valley, Aug. 1, 1883, *Rusby 664* (NY, PA, UO, US). GILA CO.: Tonto Basin, 1873, *Wolf & Rothrock 556* (G).

Wyethia arizonica in its usual form is unmistakable throughout its range. As indicated above, it is distinguished from *W. amplexicaulis* by its smaller

[18] Series containing glabrate individuals are indicated by a dagger (†).

stature, coarse pubescence, and petiolate upper cauline leaves. In the area where the two species overlap in their distribution (e. g., Elk River, Routt County, Colorado), intermediate plants referable to hybrid recombinations have been collected.

In other parts of the range of *W. arizonica*, particularly in southwestern Colorado, there occur glabrate individuals which are difficult to separate from *W. amplexicaulis* on a qualitative basis. These individuals are referable to *W. arizonica* on the basis of the petiolate cauline leaves (a condition often approached in the other species), the habit, and the sparse pubescence. Apparently these individuals occur in colonies of the normal type, but no one has yet made this point clear. This much may be said, however. The glabrate specimens occur far to the south of any colonies of *W. amplexicaulis*. Furthermore, where ranges do overlap, permitting hybridization, the recombinations follow a different pattern, the hybrids tending to preserve the habit of *W. amplexicaulis*, while acquiring the pubescence of *W. arizonica*. It is probably safe to assume that the glabrate forms are not the result of genic contamination, at least in recent time, by *W. amplexicaulis*. Field studies are necessary to clear up this problem satisfactorily.[19]

EXCLUDED NAMES

WYETHIA CALIFORNICA Nutt. ex Walp. Repert. **2**:608. 1843, nomen nudum.
WYETHIA MEXICANA Wats. in Proc. Am. Acad. **25**:154. 1890, = *Vigethia mexicana* (Wats.) W. A. Weber in Madroño **7**:98. 1943.
WYETHIA CUSICKII Piper in Proc. Biol. Soc. Wash. **27**:98. 1914, hybrid, *W. amplexicaulis* x *W. helianthoides*.

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19 After the above was written, the uncertainty of this disposition of the glabrate individuals was further emphasized by two collections made in San Juan Co., Utah, by Holmgren & Hansen in the summer of 1944. One of these, no. 3469, collected in heavy soil in the yellow pine belt at The Notch, Elk Ridge, June 25 (WS), is typical *W. arizonica*. The other, no. 3482, collected in dry, gravelly soil, pinyon-juniper belt 7 mi. from Kigalia Ranger Station on way to Blanding, June 27 (WS), appears to be the glabrate form. The outer phyllaries of the terminal head of the latter specimen are twice the length of the pales. The peduncles are long and the leaves very prominently nerved. These morphological differences, combined with the differences in habitat, suggest that the situation is perhaps more complicated than the above discussion indicates.

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The collector's numbers are indicated in *italics*, unnumbered collections by a dash. The numbers in parentheses are those of the species and varieties in this treatment.

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A Peculiar Lake Sediment of Algal Origin

Harry K. Phinney

Wilson (1944) has reported the ocurrence of a peculiar colloidal gel as a bottom deposit in a glacial lake in Michigan and in personal communications has indicated its distribution in Indiana and Minnesota. His description of this material suggested that the deposit might be a long-preserved sapropelic sediment, which upon lithification could be expected to be kerogenic, and the following report contains the data derived from an examination of some of its physical and chemical characteristics.

Two small samples of this type of deposit, taken from cores recovered in boring operations in South Fishtail Bay, Douglas Lake, Cheboygan County, Michigan, were first studied. These samples were taken at a depth of 82-83 feet and 91-92 feet below the surface of the water, or 14 feet and 22 feet, respectively, below the surface of the bottom deposits. As a slow rate of deposition is indicated for such deep-water lake-bottom sediments, the age of these samples is estimated at a probable 15,000 years and 28,000 years, respectively.

The gel had been stored in the hydrated condition from the summer of 1943 until February of 1944, when this study was made. In the hydrated state it is black, showing a bronze tint in strong daylight. The texture is uniformly smooth, without evident particles. The mass is quite elastic, a ball of the gel an inch in diameter dropped from a height of three feet bounces three to six inches into the air and exhibits very slight deformation as a result of the impact. Attempts to dehydrate the gel in alcohol resulted in little loss of water from the mass. The origin and nature of this sediment are very well characterized by the definition of the origin of a sapropel given by Wasmund (1930) and Naumann (1931). Twenhofel *et al.* (1941) describes a sapropel as an amorphous sediment in which the original organic material has been largely destroyed and whose color is black, rarely brownish. It is flocculent; it may be slippery and soapy and may possess an odor of hydrogen sulfide.

Several small samples of the gel were shaken in water until they were thoroughly dispersed and direct microscopic examination was made. The visual density composition was revealed to be from 95 to 97% of diatom frustules in various stages of disintegration and from 1-2% of pollen grains. Also present, in the order of their abundance, were wood cells and cork cells showing signs of prolonged maceration, chitin from the exoskeletons of microcrustacea, fragments of moss leaves and a small amount of a hyaline material that probably is the remains of the sheaths of blue-green algae. Microchemical tests proved inconclusive in the identification of this material. In this study the two samples from different depths were shown to be completely similar in composition.

Analysis of the sediment was made after the gel had been dried in an oven at 80° C. for 24 hours. This treatment reduced the sediment to a hard, dark, greenish-gray mass that crumbled to a coarse powder when ground in a mortar.

Four analyses were made on this dried material. All of the determinations were made on the 22-foot sample except the third which, as indicated, was made from the 14-foot sample.

The first sample was incinerated to obtain some indication of the total organic content. It was found that 34.5% of the mass was volatile or completely oxidized. The ash was digested with hot hydrochloric acid and 15.6% of the total mass proved to consist of carbonates and other soluble minerals. The remaining 49.9% was assumed to represent the silicon dioxide of diatom frustules and such mineral sand as might have been present in the original sample. When the formula developed by Trask (1937),

$$(\text{Organic Material} = \frac{L(L+10)}{30},$$

in which L equals the percent of ignition loss minus $^2/_5$ of the percentage of the carbonates present) was applied, to convert the ignition loss to the approximate organic material content it was found to be 36.04% of the total mass.

The second sample was extracted with acetone, at room temperature, before ignition. In this case the ignition loss amounted to 34.2% of the total mass, the soluble minerals to 15.7% and the silicon dioxide to 50.0%. While the percentage weight determinations did not demonstrate that organic material soluble in hydrocarbon solvents was present in any quantity, the extracts gave evidence of containing a relatively large amount of pigment and fatty material.

The third sample, which represented the 14-foot level, was extracted with petroleum ether and the only determination made was to compare the amount of pigment with that of the acetone extraction of the second sample. It was quite apparent that the color of the two solutions was identical and that the petroleum ether solution contained but slightly more pigment.

A fourth sample was repeatedly extracted with acetone, which removed organic substances to the amount of 2.5% of the total mass, and then it was treated with petroleum ether which removed an additional 3.5%. This was not assumed to represent a complete extraction of the fatty substances, for, as pointed out by Trask (1937), much of the fatty materials may be bound as insoluble soaps of calcium, magnesium and aluminum. When the inorganic and insoluble residue was incinerated it was found that the ignition loss was only 29.2%. The soluble mineral portion of the ash of this sample amounted to 15.5%. Since the mineral residues in all the samples were approximately the same it was assumed that only a small proportion of mineral ions are contained in the organic substances that were extractable.

The preceding analysis made it evident that the bronze tint, mentioned in the description of the hydrated gel, had appeared in the solvents as a definite yellow-green coloration. Attempts at absorption spectrum analysis showed that the solutions contained a mixture of substances that, without further separation could not be determined by spectroscopic methods. The amount of material was so limited that attempts at separation of the components according to their differential solubilities were unsuccessful. An additional complicating factor was the presence of the fatty material which has great affinity for the

pigments. Strain (1942) has called attention to the effect of fatty, colorless materials that decrease the adsorbability of carotenoids when studied by chromatographic methods. It is possible that this same effect was exhibited in this case.

Sample	Organic Material Soluble in Acetone	Organic Material Soluble in Petroleum Ether	Ignition Loss	Percentage of Organic Material	Inorganic Ash	Minerals Soluble in HCl	Silicon Dioxide
I	Not determined		34.5%	36.04%	65.5%	15.6%	49.9%
4.6154	Not determined		1.5901		3.0253	0.7246	2.3007
II	Not determined		34.2%	35.38%	65.7%	15.7%	50.0%
1.1596	Not determined		0.3977		0.7619	0.1817	0.5802
IV	2.5%	3.5%	29.2%	37.67%	64.9%	15.5%	49.2%
5.4319	0.1411	0.1864	1.5867		3.5177	0.8435	2.6742

Summary of Data—The percentage composition is given in the top line and the weights in grams are given below.

In order to facilitate the study of the pigments, Dr. Wilson kindly supplied several hundred grams of the hydrated gel, taken from various depths and localities in Douglas Lake, and a similar quantity from Shoe Lake, Kosciusko County, Indiana. The Shoe Lake material was studied first to determine its similarity to that from Douglas Lake. Macroscopically the samples are similar in color, but the texture of the Shoe Lake sediment is more fibrous and contains a greater amount of mineral sand. Microscopic study shows relatively fewer diatom frustules and pollen grains as well as greater numbers of wood fibers and cork cells and much quartz.

When dried a 500 gram sample of the Shoe Lake gel lost 91.3% of its weight. The paper on which it was dried was slightly stained. The dry mass was light gray and much flecked with sand. The fibrous nature was still evident when the mass was broken up, and a hard cartilaginous consistency was very noticeable. A 30 gram sample was ground and extracted by refluxing with acetone for one hour. The solvent was filtered off and chilled in an effort to remove the fatty materials from solution. It was filtered again while cold; the pigments were found to remain with the fatty residue and the filtrate to be practically colorless. The filtrate was concentrated under reduced pressure but the amount of pigment was too small to attempt a separation. Treatment of the residue with other solvents proved the pigments to have a greater affinity

for the fatty fraction of the residue than the solvent, and they gave the fatty fraction a pale greenish-yellow tint.

A 300 gram sample from Douglas Lake was similarly dried with a loss of 80.3% by weight of water. A 50 gram dried sample was ground and extracted as above. The filtered solvent was a definite yellow-green. When chilled a greenish-yellow residue was filtered out, and the filtrate retained the pigments. The customary separation procedure was followed to yield fractions containing carotene, xanthophyll, chlorophyll a and chlorophyll b. These fractions were studied spectroscopically by Dr. I. M. Klotz of the Technological Institute of Northwestern University. The sample labeled carotene contained little if any carotene. Xanthophyll was present in the fraction as labeled as indicated by an absorption peak in the region of 4000-5000 A. This sample also contained a little chlorophyll. Both fractions labeled chlorophyll contained chlorophylls as indicated by absorption peaks in the neighborhood of 4200 A and 6600 A, however the two types were not distinguishable as more dilute solutions, clear of fatty materials would be necessary to detect differences.

These fractions were placed in the cold chest of the refrigerator, and in a few hours an additional deposit of fatty material was noticeable in the bottoms of the vials. As has been suggested, in the case of both the sediments studied, this substance interfered with the normal application of differential solubilities in the preparation of the separate pigment fractions. Prolonged storage proved that the pigments undergo the same changes as plant pigment extracts made from recently living material.

The persistence of the fatty materials and pigments in a deposit of the age of the Douglas Lake sediments indicated that, in some cases at least, the cold oxygenless bottoms of deep lakes may act as storage places for organic remains fully as effectively as the peat deposits of shallower bog lakes and more effectively than deposits in marine situations. Illustrating this latter point, data by Trask (1937) on recent inshore marine deposits shows the average content of organic matter to be about 2.5% and that burial to a depth of one foot will result in the loss of 15% of the organic material as a result of the activity of living organisms and the physical and chemical interaction of the components of the sediment. By the time consolidation of the sediment occurs 40% of the organic material has been lost. That a similar loss of organic material from some lake sediments occurs is evident from the data in Twenhofel's study (1934) showing great variation in the amount of organic material preserved in sediments in lakes of the same age and origin. The causes of these variations are incompletely understood. The destruction of the organic portion of a bottom sediment occurs more rapidly in shallow lakes where the oxygen content of the bottom waters is high. The remains of dead organisms may also undergo more or less complete degradation while being transported from areas of shallow water to the final point of deposition of the sediment. Lakes with relatively great expanses of shallow water offer the greatest opportunity for such necrobiological, physical and chemical changes as are involved in this process.

Reports of the occurrence of pigmentary compounds of the types synthe-

sized by plants and animals, found in various kinds of deposits, have been summarized by Fox and Anderson (1941) and by Fox (1944). In all but one case the pigments are of the polyene and porphyrin series or are degradation products of chlorophyll. In the marine sediments studied by Fox the carotene type is in preponderance. Fox found "80% or more of the total sedimentary polyene pigments as carotenes. . . ." (Fox, 1944, p. 112.) The aforementioned exception was reported by Klimov and Kazakov (1927) by reference to a chlorophyll-bearing fraction discarded during their studies of the carotinoid pigments contained in sapropelic sediments of lakes. Since there was no indication of their age, these sediments were assumed to be of very recent origin because their carotenoid content was much higher than would be expected in deposits of considerable age. Dhéré and Hradil (1934) and Treibs (1934) list, as extractions from petroleum and from kerogenic strata, desoxophyll-erythrin and desoxophyllerythro-aetioporphyrin, which are described as acidic derivatives of chlorophyll as well as metallic salts of porphyrin.

That the Diatomaceae, whose remains form such an important part of the sediment, are also responsible for the pigments in the deposit from Douglas Lake, is not to be doubted. Carotenoid pigments might have their source in the pollen fraction of the sediment. Haas *et al.* (1942) have reported the production of carotenoid pigments by bacteria grown in media containing mineral oil. Chlorophylls, however, are not contained in pollen grains; nor have they been suggested as metabolites of heterotrophic plants. Seybold and Engle (1938) reported finding chlorophyll a, carotene and xanthophyll in an unidentified diatom. Pace (1941) found chlorophylls a and b, carotene and five xanthophyll pigments in a marine diatom. A thorough investigation of the pigments of five species of marine diatoms by Strain *et al.* (1944) demonstrated the presence of chlorophylls a, a′ and c, β and ϵ carotene and five xanthophyll pigments. The failure to recover the hydrocarbon types of polyene pigments in the present investigation may be the result of their disintegration upon being subjected to the vigorous drying and extraction processes while adsorbed on the colloidal sediment.

No decision can be reached as to the relationship of this sediment to oil shales. Algal origin for such shales has been discussed by White (1908), Zalessky (1914, 1929), Theissen (1925), Potonie and Helmers (1928), Blackburn (1936) and others. All of these data suggest that a member of the genus Botryococcus or of an ancestral form genus is often responsible for such formations. The frequent, although not invariable, association of deposits of diatomaceous remains with petroleum deposits has long caused speculation as to the part played by these organisms in the formation of petroleum. Trask (1937) preserves a noncommital attitude by indicating that sediments containing organic compounds deficient in oxygen (fatty substances?) are the most favorable "mother rock" of petroleum. Twenhofel and McKelvey (1941) report the finding of gaseous, liquid and solid hydrocarbons in lake sediments. Although specific hydrocarbon materials have not been determined from the Douglas Lake sediment the high organic content combined with the high percentage of fatty substances would appear to be presumptive evidence of generic

relationship with kerogens when the age and unconsolidated nature of this deposit is appreciated.

I wish to acknowledge the aid and encouragement offered by Dr. I. T. Wilson in supplying the samples of the sediment and his notes concerning them. I would like to express my thanks to G. E. Scharf for reading the manuscript during its preparation, and to Dr. I. M. Klotz for his technical assistance. The analysis of the sediments was carried out in the botanical laboratories of Northwestern University with the aid of the Wade Fetzer Fellowship, and the manuscript was prepared in the Osborn Botanical Laboratory of Yale University with the aid of the Theresa Seessel Fellowship.

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Experimental Studies on the Life Cycle of Glypthelmins quieta (Stafford, 1900), a Trematode of Frogs[1]

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1. Introduction

In June of 1937 cercariae were found emerging from *Physa gyrina* brought into the laboratory from a temporary pond near Urbana, Illinois. Numerous invertebrates were exposed to these cercariae with negative results. Cercariae also failed to penetrate tadpoles of *Rana pipiens* (Leigh, 1937) and larval *Ambystoma tigrinum*.

The first promising sign was the attempted penetration of the skin of a small unidentified salamander that had completed metamorphosis. However, few of the cercariae completed penetration and encystment. Obviously the salamander was not a normal host.

About this time, *R. pipiens* tadpoles were completing metamorphosis in the small pond from which infected snails and the other experimental animals had been taken. Upon exposure of these metamorphosed frogs to the cercariae, penetration was rapid and complete, indicating that frogs might be a normal intermediate host.

The habit of ingesting its cast skin during the molting process further suggested that an adult frog, in addition to acting as intermediate host, might also serve as definitive host. Subsequent examination of naturally infected frogs revealed immature trematodes in the intestine markedly resembling the cercariae under observation. Experimental work confirmed the correctness of the assumption that the encysted forms reached the definitive location in the frog's intestine via the ingested cast skin.

The cercaria was identified as *Cercaria mesotyphla* (Miller, 1935) and the adult trematode into which it develops as *Glyphthelmins quieta* (Stafford, 1900). From the nomenclatorial view, *C. mesotyphla* falls as a direct synonym of *Glypthelmins quieta*, but as a matter of convenience and ease of reference the cercarial stage will be designated as *C. mesotyphla* in this paper.

In the period from 1937 to 1938, the writer carried on an experimental investigation of the life cycle of *Glypthelmins quieta*. After preliminary

1 This paper is based on a doctorate thesis submitted to the Graduate School of the University of Illinois in 1938. The writer is deeply appreciative of the valuable assistance rendered by Professor Harley J. Van Cleave who made the study possible and who has edited the manuscript for publication.

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announcements of the stages in the life history had been published, these researches were interrupted. The writer briefly outlined the life history of this trematode in 1937 (Science 86:423) and in the same year (1937a) published an abstract of experimental results (Jour. Parasitol. 23(6): 563). A somewhat fuller account, including presentation of experimental data, was printed privately (Leigh, 1938) as an abstract of a doctoral dissertation. In 1944, Rankin gave a review of the genus *Glypthelmins* in which he included an account of *G. quieta*. His account in some rather important respects differs from unpublished observations of the writer. Consequently, the original thesis has been revised, condensed, and prepared for publication, directing particular emphasis upon details of observation and the experimental aspects of the problem.

Rankin, on the basis of similarities between *Cercaria hemilophura* and *C. mesotyphla*, suggests that the latter name, because of priority, be considered as a synonym of *C. hemilophura*. The present writer has not had the opportunity to examine critically the evidence upon which this claim is based and in consequence the name *C. mesotyphla*, as originally used in previous publications, is used throughout the present study. Even though the claim of Rankin might be valid it has little significance since with the determination of the life history of *Glypthelmins quieta* all provisional specific names that have been applied to larval stages of *G. quieta* since 1900 automaticaly fall as synonyms to *G. quieta*. In the determination of synonymy no order or "priority" of synonyms is ever recognized under the International Code.

The program of study has involved extensive field study and collection of hosts during the open seasons of the year. The entire life cycle as experimentally observed in the laboratory has been paralleled, except for the mother sporocyst stage, by the discovery of the same stages in naturally infected hosts.

Cercaria mesotyphla, in possessing a fin fold on the tail, belongs to the Cercariae Ornatae group, and since in this paper it is shown to be a developmental stage of *Glypthelmins quieta*, which taxonomically occupies a place in the Plagiorchiidae (Olsen, 1937), McMullen's (1937) characterization of the family Plagiorchiidae cannot be limited to forms having only the Polyadenous cercariae but must be further amended to include the group Cercariae Ornatae.

2. Materials and Methods

Only the methods and materials used in the determination and study of various stages of the life cycle are outlined in this section. Other techniques incidental to experimental work are dealt with in the text.

Cercariae for the original morphological and life history studies were obtained from naturally infected *Physa gyrina* and *Physa integra* from two temporary ponds, one being located about three miles northeast of Urbana, Illinois, and one-fourth mile north of Brownfield Woods; the other is situated about five miles east of Urbana and one mile north of Route 10. Later

experimental infestations in *R. pipiens* were secured with cercariae produced experimentally in the laboratory.

Laboratory-reared snails were not available at the time *G. quieta* eggs were available for infection purposes, so *Physa gyrina* from the Embarrass River three miles south of Champaign, Illinois, were used. After being kept in the laboratory for several days they failed to show evidence of infection with *C. mesotyphla*. However, there was a high incidence of infection with a monostome cercaria, *C. urbanensis*.

Even though these snails were not reared in the laboratory, there is no doubt that *C. mesotyphla* was produced experimentally. The high incidence of infection, 95.14 per cent, observation of the developmental stages of the two sporocyst generations, and the eventual production of *C. mesotyphla* too long after removal from the field to be a natural infection, gave assurance that the infection was secured in the laboratory. Miller (1936) found less than 3 per cent of the Physas of this species infected in the field.

Eggs for infection purposes were obtained by dissection of mature *G. quieta* removed from *Rana pipiens* caught in October in the drainage canal three miles east of Urbana, Illinois. Snails were infected through feeding on large numbers of the eggs placed in a small amount of water in watch glasses.

In early experimental work, frogs were exposed to large numbers of cercariae obtained from naturally infected snails and allowed to ingest their own skin during the normal process of molting. The only record kept was of the time of exposure to cercariae and the numbers of *G. quieta* subsequently found in the gut. In later experiments, the mouths of frogs were sewn shut with needle and thread to prevent them from swallowing their skin during molting. This method provided a record of the frequency of shedding as well as information concerning the numbers of metacercariae shed by each frog. These experimental frogs were kept standing in water about one inch deep in a long trough divided into compartments by wire gauze of quarter-inch mesh. The cast skin containing known numbers of metacercariae was force fed to other frogs to obtain the marital stage.

Miracidia (Figs. 12-14) were studied only in life, and then only in the dissected gut of snails, since the mature eggs could not be induced to hatch under the techniques used. Sections of the mature worms did not prove satisfactory in making out detailed morphology of miracidia due to the failure of the uterine eggs to section satisfactorily. Mother and daughter sporocysts (Figs. 2, 3), cercariae (Fig. 5), and their developmental stages (Fig. 4) were studied in life and from sectioned material.

Bouin's fixative unmodified, Flemming's fixative and Carnoy's solution were used as fixatives. Carnoy's caused too great a shrinkage of cells in the sporocyst stages to be of value. Flemming's gave the best fixation of germ cells and embryonic stages. Bouin's fixative was satisfactory for cercarial and marital stages.

Sectioned material was stained in Heidenhein's hematoxylin counter-stained with orange-G or eosin, Delafield's hematoxylin without a counter-

stain, and Safranin countered with light green. Ehrlich's acid hematoxylin and Delafield's hematoxylin counterstained with orange-G were used in preparation of sectioned larval and adult frog skin.

Intra-vitam stains were found useful in studying living sporocysts, cercariae, and early marital stages. Nile-blue sulphate was the most generally helpful and gave the best differentiation of germinal cells and germ balls within the sporocyst, and the best differentiation of penetration glands and ducts in the cercaria.

The adding of alcohol to the water containing cercariae to make a solution of about 5 per cent was found to be a very convenient way of concentrating cercariae for counting or fixing. The alcohol anaesthetizes them temporarily and they settle to the bottom well extended. They may be picked up with a pipette and transferred to the fixative where they die satisfactorily relaxed.

The effects of experimentally induced metamorphosis of tadpoles upon cercarial penetration will be presented in another paper (Leigh and Van Cleave, 1945).

3. Egg and Miracidium

Figs. 12-14

Description.—The mature eggs of *G. quieta* are embryonated at the time of deposition (Fig. 12). They measure about 48μ by 21μ, are oval in shape and brownish in color. The extremity at which the anterior end of the miracidium develops is operculated. Miracidia do not undergo active movement within the egg.

Few detailed observations could be made on the morphology of the mature miracidium within the egg shell due to the slight opacity of the shell. However, the primitive gut region at the anterior end and the penetration glands were visible. Numerous granules were located in the posterior half of the egg between the shell and the embryo. They have been observed in the embryonated eggs of other species (Olsen, 1937) and are interpreted as excretory products of the miracidium.

Hatching.—All attempts to remove the miracidia from the egg shells artificially were negative. Prolonged exposure to tap water, physiological salt solution, and Ringer's solution for snails failed to induce hatching of the eggs. An extract of the stomach and intestine of the snail likewise failed to achieve the desired results. Mechanical manipulation of the egg under pressure of the cover glass served only to crush the miracidium without the slightest indication of loosening the opercular cap.

Hatching takes place readily once embryonated eggs are ingested by *Physa*. The feces of snails examined three to four hours following ingestion of the eggs showed numerous empty shells with opercular caps removed. Evidently most, if not all, of the miracidia vigorous enough to leave the shells remained within the snail host, since no free miracidia were observed in these fecal preparations. Dissection and careful microscopic examination of the

intestinal wall revealed the hatched miracidia (Fig. 14), and the only observations made on living miracidia were made on these preparations.

Released miracidia exhibited only slight contractile movements and the cilia were motionless. Germ balls, four or five in number and unobservable in the unhatched miracidium, could be distinguished in the posterior half of the released embryo (Fig. 14). No epidermal plates were visible in these living forms.

Living miracidia (Fig. 14) observed in the gut usually had the anterior end protruded in the form of a prominent knob enclosing the primitive gut region. Since this condition was not evident in the unhatched miracidium it might be associated with the process of penetration.

Helisoma trivolvis from ponds where *Physa* was heavily infected failed to show a natural infection with *C. mesotyphla*. However, in the laboratory, eggs of *G. quieta* hatched in the intestine of *H. trivolvis* and the empty egg shells were observed in the feces. Evidently the active agent in inducing hatching is not of generic specificity.

Resistance of Eggs.—Since eggs dropped in temporary ponds would be subject to several months of desiccation during the summer and to freezing temperatures during the winter, a series of experiments were set up to determine the resistance of the eggs to environmental conditions. It would appear from the observations made thus far that the eggs of *G. quieta* are not viable any great length of time after deposition. The fact that cilia of the miracidia do not beat and the miracidium makes no movements within the egg shell rendered critical observations on the viability of eggs difficult.

Entire mature worms frozen solid in an electric refrigerator on November 15 and kept at a temperature of —2° to —3° C. for two months contained no eggs with normal embryos. The contents of mature and immature eggs alike were greatly shrunken and opercular caps came off in large numbers when the eggs were dissected apart by needles. This latter condition is not typical of normal eggs.

Eggs subjected to desiccation at room temperature for a period of two months also showed distinct degeneration and shrinkage of the miracidia and developing embryos. Here again many opercula were released on dissection of the egg masses in water.

Other eggs remaining in distilled water at room temperature for the same period of time contained embryos shrunken to about one-fourth their original size. Opercula were easily loosened in these eggs also.

To test the viability of these eggs which had been subjected to the three types of environmental conditions the eggs were fed to laboratory-raised *Physa* on January 13. Forty days later the snails were dissected, and all were negative for sporocysts.

It would appear from the above observations that eggs deposited in temporary ponds in the spring would not survive desiccation during the hot summer months when there was no water in the pond, nor would eggs deposited in the fall be viable in the spring after subjection to sub-freezing

temperatures. It therefore seems probable that adult worms in the intestine of frogs or stages in the life cycle within the snail hosts constitute the only means of perpetuating *Glypthelmins* while the temporary ponds are dry.

4. Mother Sporocyst

Figs. 2, 3

Location in Host.—Throughout the present account a careful distinction is made between mother and daughter sporocysts. This has been possible because the stages have been followed experimentally in the snail host. In contrast, Rankin (1944: 35) was unable to differentiate between the two generations and therefore was somewhat confused in this part of his study.

No observations have been made on mother sporocysts under eighteen days of age. Upon hatching in the intestine of the snail the majority of the miracidia evidently penetrate the anterior half of the intestine (Fig. 1), since the mother sporocysts are found concentrated in this region. However, they have been observed to develop anywhere along the entire intestine. They have never been observed developing around or immediately posterior to the stomach, a short space always occurring between the stomach and first mother sporocyst (Fig. 1).

Experimental Infections.—Snails were readily infected by permitting them to ingest embryonated eggs. Experimental infections in *P. gyrina* ranged from 1 to 56 sporocysts per individual and averaged 13.11 mother sporocysts for 35 infected snails. Ninety-five per cent of the snails examined after exposure were infected. Many of them died before cercariae were produced.

While it cannot be definitely stated that the heavy experimental infections were the cause of the high mortality rate, the fact that approximately four-fifths of the snails exposed to infection died within the first 30 or 40 days following infection, followed by a sharp decline in death rate, indicates that possibly the most heavily infected and least resistant snails succumbed and only those able to adjust themselves to the infection lived. Unfortunately, enough snails were not available to use significantly large numbers for controls, so the cause of the high mortality can only be conjectured.

Morphology and Development.—Developing mother sporocysts are roughly spherical in shape and regular in outline (Fig. 2). As the mother sporocyst develops it becomes irregularly flattened and prominently lobed in appearance (Fig. 3). The lobes are the result of the growth of daughter sporocysts attached to the inner wall. This wall is composed of a single layer of cells which in the younger mother sporocyst lie close together and possess considerable depth. In the older sporocysts the cells become very much flattened, due to the failure of the cells to multiply and grow rapidly enough to keep pace with the increasing size of the sporocyst. At this stage there is no evidence of a cuticula, muscle differentiation of any kind, or an excretory system. Polarity is lacking even in the young mother sporocyst.

The eighteen-day-old sporocyst is a fluid-filled vesicle (Fig. 2), averaging about 150μ in diameter and containing germinal cells and germ balls in

early stages of development. The germ balls may or may not be attached to the wall of the sporocyst.

When mother sporocysts are 30 to 40 days old and from 600μ to 900μ in diameter with the largest daughter sporocysts about 250μ by 80μ, the mother sporocyst wall takes on the lobed appearance (Fig. 3), mentioned above. Growth of daughter sporocysts continues until the mother sporocyst wall disintegrates or is absorbed. Daughter sporocyst masses much larger than one millimeter, show only remnants of the mother sporocyst wall as a mucilaginous substance cementing the daughter sporocysts together and making it extremely difficult to separate them intact. Finally, even this material seems to be absorbed, since more advanced daughter sporocysts are easily separated. This complete dissolution of the remains of the mother sporocyst at least in part explains Rankin's (1944: 36) surprise at finding no physiologically exhausted sporocysts.

Daughter sporocysts never actively migrate from the original site of the mother sporocyst. Even when a mass of daughter sporocysts of diverse origin reaches a size of three or four millimeters, it can be divided easily into component parts which represent the original mother sporocysts. In later growth, daughter sporocysts of different origins become inseparably entwined in the liver tissue of the host.

The mother sporocyst of *G. quieta* contrasts markedly with the mother sporocysts of some other described species which produce Xiphidiocercariae. For instance, the mother sporocyst of *Lecriorchis primus* (Talbot, 1933) is described as an elongate structure possessing a birth pore through which daughter sporocysts actively migrate. Though Rankin claims to have observed a birth pore, neither his figure nor his description seems to offer convincing support to his claim. Extended observations on sporocysts of various ages have failed to give any evidence of the presence of a birth pore.

Variation in Size and Rate of Growth.—Mother sporocysts of the same age in the same snail exhibit a wide range in size variation which is reflected in a corresponding variation in the size of the contained daughter sporocysts. It is not uncommon for snails to harbor mother sporocysts containing very immature daughter sporocysts when other daughter sporocysts in the same host and from the same infection are producing mature cercariae. Also in different snails infected at the same time the rate of growth of the mother sporocysts varies greatly.

It can not be stated that large or small numbers of sporocysts entirely explain the size variation, as an examination of Table 1 will reveal. For instance, at 33 days, 2 snails having 7 and 56 sporocysts, averages were 638μ and 558μ , respectively. At 18 days, in snails harboring 9 and 18 sporocysts, averages were 179μ and 149μ, respectively.

Additional evidence that number of sporocysts is not an important factor in size variation is the occurrence of snails with only a few sporocysts all greatly retarded in growth. In one instance, 89 days following infection, when other snails were producing cercariae, 1 snail harbored a single mother sporocyst containing only 4 very immature daughter sporocysts from 67μ to 75μ in length.

The above-mentioned facts seem to indicate that rate of growth is dependent on an equilibrium established for two forces, namely, the individual resistance of the snail host to establishing and growth of the parasite, and the power of the parasite to establish itself in its host in opposition to any resistance that may be present.

TABLE 1.—Range in number and size (in microns) of mother sporocysts at various ages.

	No. of Snail	No. of Sporocysts	Minimum Size	Maximum Size	Average Size
18 Days	1	5	107	130	114
	2	9	95	200	179
	3	18	67	200	149
28 Days	1	14	133	200	156
	2	20	200	465	340
	3	21	266	600	444
	4	26	120	320	207
33 Days	1	7	253	920	638
	2	8	315	810	606
	3	25	119	319	217
	4	56	359	670	558

5. Daughter Sporocyst

Morphology and Development.—Mature daughter sporocysts (Fig. 4) are elongated, unbranched, bluntly rounded at the two extremities, orange pigmented, unspined and unciliated. They may be evenly cylindrical, but usually they exhibit an attenuation at one end which lends a club-like appearance to the sporocyst. The body wall is composed of two layers, an outer sheath of flattened epithelial cells without a cuticula, and an inner layer containing elastic fibers and non-cellular in appearance, except for the polar extremities.

In the younger sporocysts, the cells of the outer layer possess considerable depth and are close together. As the sporocyst increases in size these cells become thin, irregular in shape and greatly flattened. Because this layer is mucilaginous, the separation of individual sporocysts in life is a difficult matter. The outer wall degenerates quickly after removal of the sporocyst from the snail. However, the inner wall protects the contents for some time following the degeneration of the outer wall.

The inner wall separates easily from the outer in mature sporocysts and is evident in most freshly dissected sporocysts. In contrast with the outer layer the inner wall does not appear cellular, except for occasional scattered cells and the masses of epithelial cells at one or both poles. This condition is the result of the breakdown of cell walls and the differentiation of circular and longitudinal elastic fibers. No birth pore has been observed.

There was no evident constancy in the size of daughter sporocysts at the time they produced mature cercariae. Sporocysts known to have produced mature cercariae have measured as little as 700μ to 800μ in length and 125μ to 140μ in width, while other sporocysts over one millimeter in size did not appear to have mature cercariae. Miller (1936) reports *C. mesotyphla* sporocysts of 5.70 mm. in length and 0.43 mm. in width. Sporocysts produced experimentally did not greatly exceed 2 mm. At that time all the snail hosts were dead following a period of 40 to 60 days of cercarial production.

Usually any one snail harboring mature or nearly mature daughter sporocysts would have, as component parts of the same sporocyst mass, daughter sporocysts representing all stage in development back to relatively undifferentiated germinal cells and germ balls. It was not uncommon to have productive sporocysts of one millimeter or more in length in the same mass with undifferentiated sporocysts of less than 100μ in length. This variation in rate of maturity would extend the period of maximum cercarial production.

Movement and Migration.—Any movement of the sporocysts is to be attributed to the movements of the active cercariae within. No movement has ever been observed in sporocysts that did not contain mature cercariae. Miller (1936), in reference to the movement of *C. mesotyphla* sporocysts, states "The free end often moves slowly back and forth, resembling some algae in this respect, and even contracts and extends, although not to any appreciable degree." Rankin (1944) imputed similar powers of independent movement to the sporocysts. Any movement or extension observed by the present writer was due to the extension and movement of the active cercariae, and any contraction was due to the elastic nature of the inner wall which caused it to resume its normal state when cercarial pressure was removed.

Individual groups of daughter sporocysts could be identified as developing from single mother sporocysts after cercariae were being produced, providing the infection was not so heavy as to obscure the boundaries of these groups. Growth into liver tissue must occur only in well-aged infections, since in experimental snails the liver had not yet become involved after sporocysts had been producing cercariae 40 to 60 days and were over two millimeters in length. Even in snails so heavily infected that the sporocyst mass almost equaled the visceral mass, the liver was still uninvolved. Yet in sectioned snails, naturally infected, the liver tissue has been observed to be almost entirely replaced by the sporocyst mass.

Granddaughter Sporocysts.—In two instances, typical daughter sporocysts containing cercarial germ balls were observed to contain developing daughter sporocysts. Since this phenomenon has appeared so infrequently, no more than the mention of its occurrence will be made at this time. This observation is of increased interest in view of Wesenburg-Lund's (1934) statement that "In no case have I seen these daughter sporocysts produce a new sporocyst generation among Xiphidiocercariae . . . ."

Time of Maturity.—Under laboratory conditions at room temperature daughter sporocysts produce mature cercariae at about 60 days. This may

be a longer period than is required under normal summer temperatures. There was considerable variation in the time of appearance of the first cercariae in snails infected at different times of the fall and winter. Snails infected on October 5 were not observed to produce cercariae until the 90th day, although they may have appeared a few days before that time. Others infected October 28 produced cercariae at 70 days. Snails infected November 15 and 20 produced cercariae in 61 and 58 days, respectively.

The longer period of development in the earlier infected snails was probably due to fluctuating laboratory temperatures during October and November when the heating of the building was sporadic. Snails infected in the middle of November were subjected to more even laboratory temperatures during December and January and matured earlier.

6. Cercaria

Classification and Snail Hosts.—*Cercaria mesotyphla* Miller (1935), one of the group Xiphidiocercariae Ornatae, is a stylet cercariae possessing a ventral fin fold on the tail (Fig. 5). *C. mesotyphla* has been reported (Miller, 1936) from *Physa gyrina* from ponds near St. Joseph and Rantoul and from the Embarrass River near Urbana, Illinois; from *P. gyrina hildrethiana* taken from an oxbow at Muncie, from Camp Creek at Seymour, and from East Lake Fork near Sadorus, Illinois; and from *P. halei* collected at Alhambra, Illinois.

Natural infections have been found by this writer in *P. gyrina* from a roadside ditch near Thomasboro, from an oxbow at Crystal Lake Park in Urbana, Illinois, and in *P. gyrina* and *P. integra* from temporary ponds previously mentioned. *P. integra* is a new host record for *C. mesotyphla.*

Description.—Since the cercariae has been adequately described (Miller, 1936), no detailed account of morphology need be given here. However, some additions to Miller's description are necessary.

The penetration glands were described as 12 in number, opening through individual ducts anteriorly and superiorly to the cavity of the oral sucker. Miller failed to observe a second set of ducts and duct openings (Fig. 7) which open laterally and slightly anteriorly to the 12 which open in the region of the stylet. The ducts follow along with those proceeding directly to the region of the stylet, but diverge slightly and open anteriorly and ventrally through 8 pores, 4 on either side. These pores are difficult to observe in the living cercariae due to obstruction by the ducts proceeding to the stylet, but when stained lightly with Nile-blue sulphate they may be seen as the cercaria turns its oral sucker toward the cover glass.

The pharyngeal glands (Fig. 9) are present in the region from the acetabulum forward and are particularly numerous in the region of the pharynx. Their attentuated anterior ends lead to the anterior end of the pharynx. Cystogenous glands of variable size and shape are present throughout the body but are most abundant laterally. Their abundance in the region of the

penetration glands added considerably to the difficulty in distinguishing the penetration glands in the living cercariae.

Miller (1936: 49) described and figured (his Fig. 40) the two germ masses as lying dorsal to the ventral sucker and showing no differentiation into testes or ovary. However, in naturally and experimentally produced *C. mesotyphla*, anlagen of testes, ovary, and connecting ducts are plainly evident (Fig. 7).

The excretory system has been worked out in detail and found to be exactly as Miller (1936: 49) described it. The flame cell formula is of the $2[(3+3+3)+(3+3+3)]$ type. This formula is characteristic of subgroup 3 of the Xiphidiocercariae Ornatae to which *C. mesotyphla* belongs.

Biology.—*Cercaria mesotyphla* is an active swimmer. When inactive it attaches itself to the surface film of water or to the sides of the container at the surface of the water. Healthy cercariae are never found at the bottom of the container. When driven below the surface to any extent they quickly swim to the top. This type of selection is just the reverse of that exhibited by the cercariae of *Renifer aniarum* and *Dasymetra villicaeca* which penetrate and encyst normally in tadpoles (Byrd, 1935).

It is interesting to associate this difference in behavior with the habits of the normal intermediate hosts. Cercariae penetrating tadpoles and nymphs of dragonflies would be more likely to find their hosts if they moved near the bottom of a pond, while *C. mesotyphla* moving about at the surface of the water would be in favorable situation for contacting frogs swimming at the surface or sitting partially submerged in shallow water.

The cercariae seem entirely unresponsive to changes in light intensity. They swim in and out of a strong beam of light at random and show no selection for either lighted or darkened parts of the container.

The length of life of cercariae, at room temperature of 24° to 25° C. in aged aquarium water, varies between 48 and 65 hours, although some individuals live as long as 72 hours. They are not resistant to low temperatures. Cercariae subjected to 5° C. became completely inactivated. At the end of 48 hours when returned to room temperature they recovered to the point where they showed some movement but died before becoming normally active.

An analysis of the cercarial counts (Table 2) over an extended period of time under exposure of the snail hosts to continuous periods of light and darkness indicates clearly the absence of any type of periodicity that can be associated with light responses or daily rhythm.

There is a complete lack of uniformity in the counts of cercariae emerging from infected snails when exposed to the same physical factors of light, temperature and water conditioning. There is no correlation in periods of increased and decreased cercarial production. Each snail is a law unto itself. There are periods of low and high productivity under both extremes of light intensity. A period of high cercarial production is usually followed by a period of low productivity. Production may rise, remain the same, or fall during the first 12-hour period after transference from continuous exposure to light

to complete darkness. The same is true when snails are transferred from darkness to light. Table 2 gives the number of cercariae produced by each snail under alternate conditions of light and darkness for a known number of hours. Under exposure to constant lighting for a period of 1,210 hours

TABLE 2.—Numbers of cercariae produced by each snail for the total periods of light and darkness.

SNAIL		Number of cercariae	Number of hours	Average number of cercariae per hour
A	Light	1516	551	2.75
	Dark	737	336	2.19
B	Light	655	204	3.21
	Dark	696	336	2.07
C	Light	1201	455	2.64
	Dark	1110	336	3.03
TOTAL	Light	3382	1210	2.80
	Dark	2543	1108	2.52

the 3 snails produced 3,382 cercariae, or 2.80 cercariae per hour. In total darkness the same 3 snails produced 2,543 cercariae in 1,108 hours, or 2.52 cercariae per hour. These results indicate definite lack of any direct response to changes in light intensity.

Even though there is no indication of any sort of rhythm in the low and high periods of cercarial production, there are rather great extremes of productivity for 12-hour periods. For the 3 snails that lived the longest, the extremes for 12-hour periods were as follows:

Snail	Cercariae liberated	
	Maximum	Minimum
A	94	2
B	133	7
C	340	6

Penetration and Encystment.—Cercariae show no evidence of directional swimming movements or purposive response to the presence of the frog. The first indication of selective response comes upon actually contacting the skin of the frog. If the cercaria lacks so much as a hair's breadth of touching the skin, it may swim directly away to the opposite side of the container.

The moment a cercaria swims against any portion of the frog's skin it stops swimming and quickly attaches itself, first by means of the oral sucker, then draws itself closer and attaches by means of the acetabulum. It may then

crawl rapidly over the surface for a short time by alternate fixation and relaxation of oral and ventral suckers, in the "inch-worm" fashion, but more often starts immediately to penetrate. The tail no longer undergoes the powerful swimming movements but stands straight out behind the body, exhibiting a graceful waving movement.

Penetration, once started, is accomplished in 4 to 15 minutes. The initial efforts are made with the ventral surface of the body applied to the skin and attached by the acetabulum. Using this leverage the oral sucker and its enclosed stylet make downward and forward thrusts until a break is made in the skin allowing the entrance of the anterior end. The penetration glands supposedly assist by secreting an erosive substance which is applied to the skin at the point of penetration.

When the anterior end has penetrated beneath the surface, the cercarial tail becomes detached and swims away. During the remainder of the penetration process the body may stand at right angles to the skin and force itself deeper through alternate contraction and relaxation of body musculature, or may keep the posterior end of the body, with acetabulum unattached, in contact with the skin as a point of leverage.

Making the initial opening consumes most of the time of penetration. As soon as the opening is made, the head end is pushed in as a result of the leverage gained by the fixation of the acetabulum. Several movements of contraction and relaxation of body musculature are sufficient to take the entire body underneath the skin. Penetration has been completed in 4 minutes in the webs of toes of newly-metamorphosed frogs.

Under the skin the cercaria maintains its elongate shape during a period of migration which takes 20 to 30 minutes. The path of migration probably is between the epidermal layer and the corium since sectioned skin shows the point of encystment to be completely beneath the epidermis (Fig. 10).

The path of migration usually covers a distance from five to six times the extended body length of the cercaria. At the end of migration the cercaria contracts. Further extension and contraction at various angles serves to increase the size of the space. When the skin layers have been separated by these movements, the cercaria flexes its body ventrally in a U-shaped manner and begins to turn over and over in various directions.

After 10 or 15 minutes of this rolling motion the cyst wall shows up as a fine line of demarcation between the host tissue and the encysting cercaria. This rolling motion is continued for 1½ to 2 hours at which time the cercaria shortens its body length and becomes quiescent. Thus, the entire process of penetration and encystation seems to be completed in less than 3 hours.

A cyst dissected out 1 hour following penetration was well formed. Encysted forms 3 to 4 hours old have lost their stylets, which may be seen floating free in the cysts. The discarded stylet leaves a discernible cavity in the dorsal lip of the oral sucker.

That the penetration of cercariae is felt by the frog host is very evident. Very shortly after exposure, the frogs rub their thighs on the sides of the body as though in an effort to dislodge penetrating cercariae. By this means they have been observed to dislodge cercariae which have not penetrated deeply.

7. Metacercaria

Morphology and Development.—The encysted metacercaria (Fig. 8) exhibits few striking changes in morphology. Loss of stylet within 2 or 3 hours following encystment, replacement of the flatened leaf-like shape by a cylindrical form, and development of a body opacity not characteristic of the free swimming cercaria are among the most conspicuous changes. The size of the encysted metacercariae is variable and dependent on the state of contraction but does not differ significantly from cercarial measurements. There is no recognizable change in excretory or digestive systems.

Openings of the ducts of penetration glands, formerly definitely grouped together in the cercaria (Fig. 7), have become dispersed so that their openings are in a line along the anterior ventral margin of the oral sucker (Fig. 9). Penetration glands are still present in the encysted stage. In fact, as will be shown below, they are recognizable for a number of days after the worm arrives in its definitive location in the small intestine of the frog. The genital mass remains essentially the same as in the cercaria, testes and ovary having separated from the main mass of germinal rudiments (Fig. 8).

To the naked eye the encysted metacercaria appears as a small, circular skin elevation possessing a yellowish border. In the transparent molt layer metacercariae are visible as opaque-white spots. The cysts are oval in shape and, from measurement of 30 cysts, exhibit variations from 200μ to 252μ in length and 160μ to 200μ in width. Metacercariae are invested closely by a thin, transparent cyst wall capable of standing considerable pressure. Size of the cyst is not increased during the metacercarial existence. This is indicated by the fact that measurements of 4- or 5-hour-old cysts fall within the size range of cysts in cast frog skin.

Relationship to Host Integument.—Location of the encysted form in the integument of the host is shown in Fig. 10. Usually the cyst lies completely subjacent to the entire epidermal layer which, at the site of the cyst, is slightly elevated above the general level of the epidermal layer.

In every instance where cysts were sectioned within the integument, the epidermis showed a marked thickening in the region directly peripheral to the cyst (Fig. 10). It would appear that the presence of the cyst stimulates the cells in the adjacent region to increased multiplication. This thickened area of the epidermis is shed along with the cyst as an epidermal pad to which the cyst is attached (Fig. 11).

Biology.—In contrast to the quick dissolution of the encysted cercariae in artificial media, the encysted forms are able to exist for a number of days. Cast from the host in the body molt, they will remain alive within the cysts for from 5 to 10 days. Viability at the end of that time has not been tested. Under laboratory conditions frogs were observed to shed at irregular intervals of 2 to 7 days.

In view of the relatively short time between body molts, frogs may be repeatedly subjected to reinfection. Eleven very young frogs exposed to numerous cercariae from July 14 to 22 and examined July 29, 7 days following the last exposure, had from 100 to 300 intestinal *G. quieta* per frog but no

integumental encysted forms. In other words, all encysted forms had been shed with body molts in the 7-day interim. Older frogs retained the encysted metacercariae in the integument during a longer period, 13 or 14 days, and shed encysted forms for the first three or four molts following cessation of exposure to cercariae.

The metacercariae, considering their rapid encystment and slight development over cercarial structure, probably become infective in a few hours. Olsen (1937) states that the metacercariae of *Haplometrana utahensis*, a form closely related to *G. quieta* and with a similar life cycle, become infective in 12 or 13 hours. Encystment is necessary to the successful completion of the life cycle of *G. quieta*, since cercariae introduced directly into the stomach of the frog host were digested.

There is little danger of the metacercariae being introduced into the digestive tract of the frog in an immature condition due to the fact that cercariae encyst almost or completely underneath the epidermis. Frogs exposed to cercariae do not ordinarily shed metacercariae at the first and sometimes the second molt subsequent to exposure. Thus the metacercariae have ample time to develop to the infective stage.

The above adaptation and the failure of the cercariae to encyst in tadpole skin, where they would never be able to finish their life cycle, may be regarded as compensatory adjustments to the immense waste occasioned by the alternation of hosts.

8. Marita

Description and Development.—Since the marital stage of *G. quieta* was redescribed in detail by Miller (1930) no description need be included in this paper. The normal habitat of the marita is the small intestine of frogs. Though the majority of worms harbored by any one frog are concentrated near the inner surface of the duodenum where the blood supply is richest, blood has never been observed in the ceca of the mature worms.

Numerous observations have confirmed the fact that metacercariae gain access to the intestine of the frog when the stratum corneum containing the encysted forms is ingested by the frog during the molting process. Metacercariae have been found, both before and immediately after encystation, in the stomach and intestine of frogs which have ingested their cast skin. Excystation is complete in from 12 to 16 hours.

After spending a period of 7 days in the intestine of the frog, a developing marita presents the following appearance. There is no noticeable increase in size of the entire individual. From 15 measured preserved specimens there is a size range of from 320μ by 120μ to 440μ by 120μ, measurements which fall well within the range of cercarial body measurements. Talbot (1933) states that the marita of *Lechriorchis primus* does not grow for the first 10 days in the intestine of the frog. Evidently the first few days serve largely as a period of reorientation to the new host.

The body is elongate and roughly cylindrical, as was the metacercaria, but differs from the latter in that the muscle system, as evidenced by the

greatly increased activity of the worm, is much advanced over that of the metacercaria which, when released from the cyst, undergoes little movement. The body parenchyma, in contrast to the opaque, fragile condition of the metacercaria, has become relatively transparent and resistant to adverse physical factors. While at room temperature the metacercaria succumbed in 4 to 6 hours in physiological salt solution, the 7-day marita lived for 4 to 5 days.

The most striking change in the 7-day marita over the cercaria and metacercaria is the appearance of a set of glands and ducts not evident in the preceding stages and a realignment of the openings of the cercarial penetration glands. The terminal portions of the ducts and duct openings of the realigned penetration glands are much enlarged in the marita, making them far more conspicuous than they were in the cercaria. Although only 20 duct openings were observed in the cercaria, as many as 24 were counted in the 7-day marita and later developmental stages. As the marita becomes older and larger in size, the terminal parts of ducts with their prominent pores may be found loose in the parenchyma as far back as the pharynx. No doubt this is due to a growth of the worm without an accompanying growth or stretching of the ducts of the penetration glands.

A most interesting development occurs in the marita that could not be found in the living cercaria even after careful study at a magnification of approximately 1,000 diameters. An additional set of medial glands and ducts are visible in the 7-day marita. The glands are indistinct and, as mentioned in the description of the cercaria, are located medially and slightly anterior to the penetration glands. The thread-like twisted ducts, three to five in number, run anteriorly to the region of the pre-pharynx where they turn medially, become swollen in the terminal portions, and open through minute pores into the pre-pharynx (see Fig. 9). The exact number of medial glands and pores is uncertain. From 13 to 18 pores and 8 or 9 glands on a side have been counted. The glands are of the same indistinct granular appearance as the penetration glands visible in the cercaria and carried over into the marital stage. At first it was thought that these glands were the anlangen of the conspicuous pharyngeal glands of the advanced marita. However, further observation showed that these glands disintegrate completely while the pharyngeal glands have their origin from an entirely different group of cells located adjacent to the anterior border of the pharynx (Fig. 9) and extending along the sides of the pharynx as a narrow band. The medial glands can be observed in living and occasionally in stained mounts undergoing progressive degeneration up to the 46th day of marital existence. They undoubtedly exist for even a longer period, since at 46 days they are still obvious as granular, branching, tubular structures.

The function of the medial glands, which could not be observed in the cercaria, and have only a brief existence in the marita, is not obvious. The structure of the glands and appearance of the ducts and duct openings are similar in all respects to the recognizable penetration glands of the cercaria. However, since they could not be observed in the cercaria, it does not seem

likely that they could function in aiding penetration. Their opening into the prepharynx would argue against any function in cercarial penetration even though they were present in the cercaria. Since they have only a limited existence and degenerate along with the penetration glands, it seems reasonable to believe that they have some obscure evolutionary significance.

The detailed development of organ systems has not been followed in the marita, but a few observations have been made on early changes in the excretory and reproductive systems. Changes in organ systems could be followed only to about the 60th day, since no frogs were kept alive beyond that time.

The number of flame cells and tubules remains unchanged from cercaria to mature marita, but the excretory bladder undergoes a considerable change in shape. In the living 7-day marita the bladder still retains the two vesicles characteristic of the cercaria, but in preserved individuals it is much smaller in diameter and the two vesicles are represented only by two enlargements. In 15-day and older marita the bladder takes on a tubular appearance, but slight anterior and posterior swellings reminiscent of the two-part bladder of the cercaria are retained.

The male organs of the reproductive system develop much more rapidly than the female organs. At 7 days the testes have become distinctly separated from the main mass through the lengthening and narrowing of the developing vasa deferentia. The cirrus pouch has begun to take recognizable shape, although no connection has been made with the outside. The ovary has changed little and the anlage of the uterus is recognizable only as a U-shaped mass of cells, one end of the U extending to the region of the future genital pore and the other end joined to a mass of cells recognizable as the anlage of Mehlis' gland.

At 15 days the genital pore has been formed, and a rapidly-developing cirrus pouch has made connection with the pore. Testes have increased to three or four times their size at 7 days, while the ovary has less than doubled its diameter. The fundament of the uterus has extended its loop ventrad to the testes and to a point approximately one-fourth of the way from the testes to the posterior end of the body. Mehlis' gland is clearly recognizable at this stage as an oval-shaped mass of cell in the midline just anterior to the testes. It is joined by the oviduct on the side nearest the ovary and with the end of the U-shaped, developing uterus arising from its posterior border.

At 40 days the uterus, a solid cord of cells, has extended about two-thirds of the way from testes to posterior end of the body. At 60 days it has reached the posterior end of the body and is definitely distinguishable as a descending branch arising from Mehlis' gland and continuing as an ascending branch to the well-developed genital papilla containing the genital pore. No secondary loops have been formed, no well-developed lumen is present, and the cellular nature of the walls is still very evident. No recognizable vitellaria have appeared.

The age at which *G. quieta* reaches maturity has not been determined. The first set of experiments was performed in late fall when conditions were

not favorable to keep frogs alive and well fed under anything approximating normal conditions. All experimental frogs died by the time the marital stage was 60 days old. Considering the degree of development evident at 60 days, it seems likely that the probable time of maturity is around 3-months' time. Judging from the slow rate of growth, the maximum size of the fully adult marita is probably not attained before 2 years of age. There is little doubt but that the worms remain in the frog gut during hibernation.

Ward's (1909) paper is of interest here. He states that the trematode parasites of *Rana pipiens* hibernate with their host and are lost at the time of spawning. The fact that ova are retained during hibernation would seem to be a favorable adaptation in view of the lack of resistance to freezing temperature mentioned in a previous section. Olsen (1937) found that *Haplometrana utahensis*, with a similar life cycle became mature in the frog gut in 50 days and states that maximum growth probably involves a 2-year period. He found mature worms in frogs coming out of hibernation.

Incidence of Natural Infestation.—Eighteen newly-metamorphosed *R. pipiens* examined on July 7 and 8 from a small pond north of Brownfield Woods, in which infected snails were present, showed no infestations with *G. quieta*. However, on July 22 and August 1, of the 27 young frogs collected from the same place, 19 harbored immature *G. quieta* in the intestine.

Of the 24 frogs, large and small, collected from the Drainage Canal, east of Urbana, on October 1 to 11, just before the frogs went into hibernation, 19 were infested with *G. quieta*. Of 101 frogs examined from July 7 to October 11, all collected from the vicinity of Urbana, 47, or 46.3%, were naturally infested with *G. quieta*.

Natural and Artificial Infestations.—Natural infestations of *G. quieta* range from 1 to 65 per host individual while few frogs experimentally exposed to large numbers of *C. mesotyphla* will fail to show 100 to 300 immature *G. quieta* in the intestine after a few days' time. In the heavy infestations produced experimentally, a large percentage of the worms die after several weeks' time and may be found in considerable numbers quiescent in the colon or passed in the container. This may be due to lack of food, resistance of the frog to heavy infestation, or insufficient viability of some of the parasites. All of this group of experimental frogs died before the trematodes became fully mature, but those living 40 to 50 days after exposure had numbers considerably under 100 in contrast to the prevalent infestations of 200 to 300 in frogs examined 10 or 15 days following exposure.

The average natural infestation per frog, for 73 *R. pipiens* examined from July 22 to October 11 was 4.4 *G. quieta* per frog.

9. Germ Cell Cycle

No attempt has been made as yet to work out the complete germ-cell cycle of *G. quieta*, but observations have been made which suggest the method by which multiplicative processes take place in the sporocyst generations.

It is not advisable at this point to go into a discussion of all the theories concerning the germ-cell cycle. Brooks (1930), Cable (1934), and more recently, Cort (1944) have reviewed the literature and have added their interpretations to the ever-increasing literature on the problems of the germ cells in digenetic trematodes.

The observations made thus far on sectioned mother and daughter sporocysts of *G. quieta* at various stages in their development support the theory of germinal lineage with polyembryony. An examination of sectioned young mother sporocysts reveals nothing that would suggest that the wall of the sporocyst serves as a germinal epithelium. No cells were found that would indicate that they were being or had been extruded from the sporocyst wall. The size and staining quality of the nuclei of the cells in the sporocyst wall do not resemble those of germ cells.

The youngest mother sporocyst found in sectioned material was only 75μ in diameter and contained only germinal cells. The majority of the cells were lined up close to the wall. Many were in direct contact with the wall and, since in later stages embryonic daughter sporocysts usually develop in connection with the sporocyst wall, might derive nourishment directly from the cells of the mother sporocyst wall.

The germinal cells in the mother sporocyst, before any cleavage has taken place, vary in size and shape but possess large spherical nuclei surrounded by only a thin layer of cytoplasm. Chromatin material is connected in one or two endosomes of varying size. Small granules are scattered throughout the nucleus, peripheral to the endosomes. The germinal cells individually give rise through cleavage to the daughter sporocysts.

Nothing resembling an ovary has been observed in either mother or daughter sporocyst. Often single cells or groups of cells are attached to the body wall by a cytoplasmic stalk so as to give the appearance of being budded or extruded from the sporocyst wall. This stalk, however, is better interpreted as a point of attachment for a cell which originated within the body cavity and not from the sporocyst wall.

A number of workers have described areas within daughter sporocysts which they have interpreted as a germinal epithelium. Since the younger sporocysts and rediae have a rather thick epithelial lining, especially when they are in a state of concentration, the lining has been interpreted as germinal in nature. Very often one or both polar extremities of daughter sporocysts have prominent epithelial thickenings. This condition is very obvious in young sporocysts of *G. quieta* but tends to disappear with the aging of the sporocysts and in some instances is entirely absent. It is these polar thickenings of the inner epithelial layer that have been so often mistaken for ovaries. In *G. quieta,* however, morphology and staining reactions in this region are typical of epithelial cells. Very often mature ex-components become attached to the inner wall, and the resulting embryo develops in close attachment to the wall. An early attached embryonic individual whose cells are loosely arranged and bounded by an investing membrane might be mistaken for an ovary, and the minute micromeres attached to the macromeres might

be misinterpreted as polar bodies. A diligent but fruitless search has been made for polar bodies.

Multiplicative processes are even more pronounced in the daughter sporocyst of *G. quieta* than in the mother sporocyst. Antecedent germinal cells divide rapidly to produce irregular masses of cells which differ greatly from developing embryos. These masses may be attached firmly to the inner sporocyst wall or lie loose in the cavity and in shape conform to the pressure brought to bear on them by developing cercariae. Single germinal cells and groups of two or more are numerous. Those giving rise to definite morulae may be distinguished from the germ masses mentioned above by the orderly cleavage, more regular outline of individual cells, lighter staining, spherical shape and regular outline of the embryo, and the heavier investment membrane. Germ masses are irregular in size and ragged in outline, lacking any definite orderly arrangement of the cells composing the mass.

The conditions of germinal cells in the daughter sporocyst strikingly parallel those of several species described by Brooks (1930). He believes that the germ masses, such as are described above, form as the result of rapid multiplication of the antecedent germinal cells carried over from the mother sporocyst generation. The masses dissociate and individual cells serve as "ex-components" which undergo cleavage and give rise to cercariae. This explanation satisfactorily describes the situation as found in *G. quieta*.

10. Summary and Conclusions

1. The life history of *Glypthelmins quieta* (Stafford, 1900) has been experimentally determined, and morophological and experimental studies have been made on the life history stages.

2. *Cercaria mesotyphla* (Miller, 1935), one of the Xiphidiocercariae Ornatae, has been shown to be a developmental stage of *G. quieta*. Therefore, *C. mesotyphla* Miller from the nomenclatorial viewpoint, falls as a synonym of *G. quieta*.

3. Cercariae penetrate the skin of frogs and encyst beneath the epidermis. Penetration and encystment have been observed in *Rana pipiens* and *R. catesbeiana*. Penetration is accomplished in 4 or 5 minutes and encystment completed within 3 hours' time.

4. Encysted metacercariae are introduced into the digestive tract of the frog host when the frog ingests its own cast skin during the process of molting. The exact time at which *G. quieta* reaches maturity is not known but is approximately 3 months after ingestion of the encysted metacercaria.

5. *C. mesotyphla* will not penetrate the tadpoles of *R. pipiens* and *R. catesbeiana* before metamorphosis of the larval integument into adult structure.

6. Present observations on the germ cells of the sporocyst generations support the theory of germinal lineage with polyembryony as an explanation for the germ-cell cycle of *G. quieta*.

EXPLANATION OF PLATES

The final drawings are by Katherine Hill Paul, scientific artist in the department of Zoology of the University of Illinois, who prepared them from preliminary sketches, most of which had been made with the aid of a camera lucida.

PLATE 1.—Stages in the development of *Clypthelmis quieta* (Stafford, 1900).

The scales indicating magnification accompanying the figures on this plate have the value of 0.01 mm., except for Fig. 2 where it has the value of 0.02 mm. and Fig. 6 where it is 0.01 mm. long.

Fig. 1. Free hand sketch of digestive tract of *Physa gyrina*, showing living mother sporocysts (m. sporoc.) attached to the outer surface of the intestine (int.). Note that no sporocysts are present in the region of the stomach (stom.).

Fig. 2. Optical section of a living mother sporocyst, 18 days after the miracidium entered the *Physa*. Each daughter sporocyst (dau. sporoc.) is surrounded by an epithelial covering (epithel.).

Fig. 3. Optical section of a 36 day mother sporocyst, showing thinning of covering epithelium (epithel.).

Fig. 4. An enlarged daughter sporocyst, with cercariae (cerc.) in various stages of development.

Fig. 5. Lateral view of mature cercaria.

Fig. 6. Stylet of cercaria as viewed from anterior surface.

Fig. 7. Ventral view of cercarial body showing cercarial penetration glands (pen. gl.) and anlagen of the genital complex (gen. compl.) Glands are shown on only one side of body.

Fig. 8. Ventral view of a metacercaria dissected from its cyst in the skin of a frog, showing anlagen of organs characteristic of adult worm, especially the genital complex (gen. compl.).

PLATE 2.—*Clypthelmins quieta* (Stafford, 1900).

Each of the lines indicating magnification on this plate has the value of 0.02 mm., except that accompanying Fig. 10 which is 0.05 mm. long.

Fig. 9. Anterior extremity of a 15 day marita, showing medial glands (pen. gl. mir.), the cercarial penetration glands (pen. gl.) and developing pharyngeal glands (phar. gl.). To avoid crowding and confusion, each type of gland is shown on only one side of the body.

Fig. 10. Section of unshed skin of *Rana pipiens* showing longitudinal section of a metacercaria encysted between the epidermis (epid.) and the dermis (derm.). Note that the outer layer of cells of the epidermis forms a stratum corneum (str. corn.).

Fig. 11. Free hand sketch of an encysted, living metacercaria attached to the cast off stratum corneum by means of an epithelial pad.

Fig. 12. Embryonated egg of *Clypthelmins quieta* at time of deposition.

Fig. 13. Miracidium emerging from the egg shell within the gut of a snail.

Fig. 14. Miracidium as it appears upon hatching within the gut of a snail. Anlagen of penetration glands (penetr. gl.) and germinal anlage (germ. anl.) are evident.

Figs. 15 and 16. Early stages in the formation of cercariae within a daughter sporocyst. From living specimens.

PLATE 1

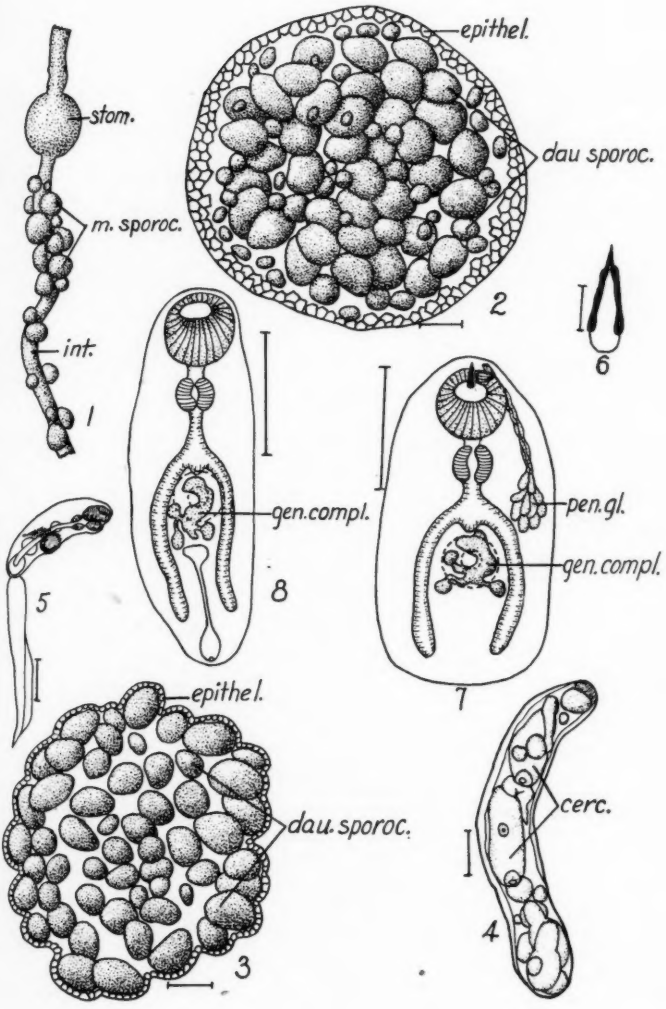
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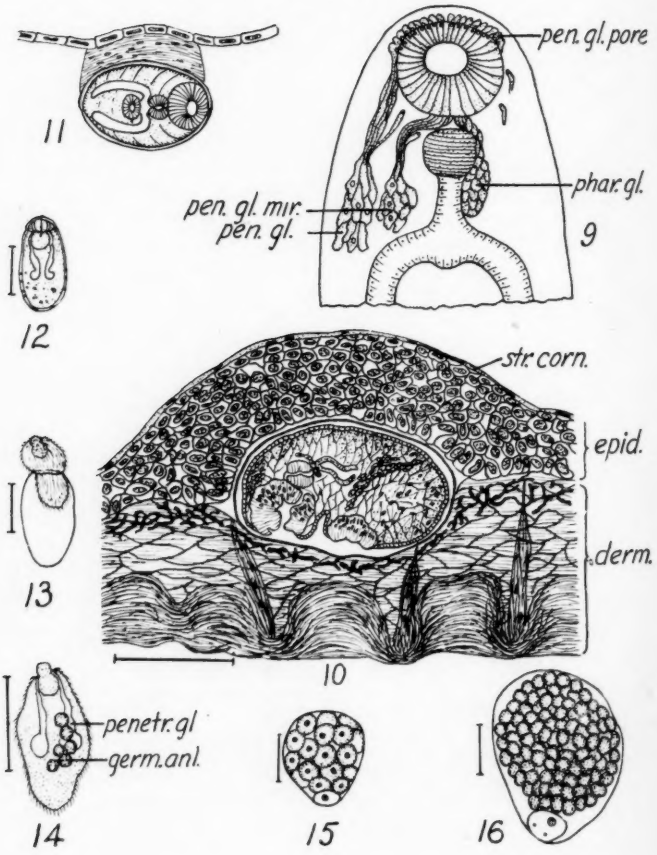
PLATE 2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Records and Descriptions of North American Crane-Flies (Diptera)[1]

Part VI. Tipuloidea of Arizona, New Mexico and Trans-Pecos Texas, 1

Charles P. Alexander

General Account

The attempted long-term survey of the crane-flies of western North America has now been extended to the point where at least a preliminary list of the species inhabiting our southwestern states may be provided. There is no question but that future collecting will add materially to the subjoined record since all such work done in Arizona, New Mexico and western Texas to the present time has been both fragmentary and seasonal to a marked degree.

Arizona and New Mexico provide an unusual range of habitats that are suitable to these flies, despite the fact that the country is chiefly one of sparse rainfall whereas the immature stages of virtually all known species of Tipuloidea require some degree of moist conditions for their development (Alexander, 1920, 1931). Although the intermountain areas of the region are largely semi-desert, the numerous mountain ranges scattered over both of these states attain heights that are sufficient to support a rich forest growth, with many conifers at the higher altitudes, and with abundant mountain streams and other wet situations much favored by these flies. Trans-Pecos Texas is included in this report since there can be no doubt of its affinities with the states to the west. Hinckley (1944) writes concerning the Davis Mountains as follows: "These are geologically a part of the Front Range of the Western Cordilleras, a system which reaches its easternmost extension in the United States within that section of Texas known as the Trans-Pecos Region."

The collections made personally by Mrs. Alexander and the writer are small and insufficient but have been supplemented by further lots of specimens derived from various sources that are mentioned later in this report. In late July 1934, we collected in the vicinity of Taos, in extreme northern New Mexico. In 1942 , a more extended trip included some collecting in the Davis Mountains in Trans-Pecos Texas; in the White Mountains and Sacramento Mountains in south-central New Mexico, and in various selected localities in Arizona, including the Chiricahua and Santa Rita Mountains, in the south-

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1 The preceding part under this general title was published in the AMERICAN MIDLAND NATURALIST **33**:391-439, 1945.

References in the text refer to the bibliography at the conclusion of the general account.

In all cases in this report where no collector is given, the specimens were secured by the author. M. M. Alexander—Mrs. Charles P. Alexander.

eastern portion of the state near Tucson; in the beautiful Oak Creek Canyon, close to the geographical center of the state, just south of Flagstaff, and on the Kaibab Plateau, constituting the north rim of the Grand Canyon, in northwestern Arizona. All such collecting was done in May and the first three weeks of June, representing the spring fauna. Due to the extreme porous nature of the soil in many of these places, specifically on the Kaibab Plateau, the streams are very ephemeral, are largely due to the melting of the comparatively heavy winter snows and virtually all had disappeared by mid-June or even earlier.

A brief discussion of the more important collecting stations is given.

Trans-Pecos Texas.—The vicinity of Old Fort Davis, in the Davis Mountains, Jeff Davis County, has long been known to be of peculiar richness and interest as regards the fauna and flora. For insects this was emphasized in the general period between 1925 and 1930 by the collections made by Mr. and Mrs. Otto C. Poling. Most of the numerous crane-flies secured by the Polings are in the University of Michigan Collection and were not received by me in time to be included in the present report. A smaller series taken between June 1927 and October 1928 is in the Oregon State Collection, having been purchased by Professor Don C. Mote. Mrs. Alexander and I collected in this vicinity on May 28th and 29th, 1942. The only stream of any permanency, Limpia Creek, rising in the mountains west of the old fort and flowing generally northward, at the time of our visit was abnormally low, with a corresponding paucity of crane-flies. It seems certain that further study of materials from this station will produce several additions to the list.

New Mexico.—Collections made at Taos, in the northern part of the state, were taken by us on July 27, 1934. Also in northern New Mexico, the materials taken at the beginning of the present century by Professor T. D. A. Cockerell (Cockerell, 1900-1902) should be noted. These were secured in the Hudsonian life zone on the summit of the range between the Pecos and Sapello Rivers, near the headwaters of the former; this is the main divide between the Rio Grande and Mississippi River systems, at an altitude of approximately 11,000 feet; collections were made here between August 1-4, 1900, and at the end of June 1901. Also taken in this same general vicinity but at a lower altitude, were the interesting specimens taken by the late Henry Skinner (Skinner, 1902-1903), secured in Sapello Canyon, in the vicinity of Beulah, some 30 miles northwest of Las Vegas, San Miguel County, altitude 8,000 feet, August 9-26, 1901. In this same general region, at Jemez Springs, altitude 6,400 feet, numerous insect specimens were taken about 1912-1916 by the veteran insect collector, John Woodgate, these including various Tipulidae. Further, I am greatly indebted to Mr. and Mrs. John L. Sperry for some unusually interesting specimens taken in Frijoles Canyon, in the Bandelier National Monument, just west of Santa Fe.

More to the south, collections made in the White and Sacramento Mountains give the impression of a rich and chiefly untouched crane-fly fauna. Our own collections (May 31-June 1, 1942) are totally inadequate, due to the earliness of the season at these high altitudes (Rio Ruidoso, White Mountains,

altitude 8000 feet; Cloudcroft, Sacramento Mountains, altitude 8000 feet). Published references to these localities include Knaus, 1903, 1904, and Townsend, 1897. The Organ Mountains (Townsend, 1898), between Las Cruces and El Paso, Texas, will undoubtedly yield various interesting Tipulidae, particularly in Fillmore Canyon and at the Dripping Spring, where Cockerell collected the type of *Tipula* (*Lunatipula*) *stalagmites* Alexander, in April 1898.

Arizona.—The mountain blocks in southeastern Arizona have long held a peculiar attraction to entomologists. These ranges include particularly the Chiricahuas, Huachucas, Santa Catalinas and Santa Ritas (Bueno, 1937). In 1942, we collected in the Chiricahuas (Rustler Park, 8500 feet, June 4-5) and in the Santa Ritas (Big Rock Camp, Madera Canyon, 5000 feet, June 8-9), securing only a few species of Tipulidae but these of unusual interest and giving the impression of a varied Tipulid fauna. Even at this early date, the small clear stream in Madera Canyon was very low and at a slightly higher altitude had disappeared. On June 7th, we spent a happy day collecting with our long-time friend, Mr. J. R. de la Torre-Bueno, along Sabino Canyon, a mountain stream originating in the Santa Catalinas, near Tucson, and flowing through the desert country frequented by the saguaro cactus.

The richest and most exciting collecting that we found in any of these states was in Oak Creek Canyon, where we camped at the Banjo Bill Forest Camp, altitude 5180 feet, from June 10th to 12th, 1942. Here we enjoyed the companionship of John and Grace Sperry, to whom we are indebted for several of our finest Tipulidae. Oak Creek Canyon will undoubtedly yield many further additions to the list of crane-flies as now known from the state. The beautiful clear mountain stream, Oak Creek, rises just south of Flagstaff, flowing southward through the canyon which is somewhat suggestive of a miniature Grand Canyon. Along the stream are great beds of yellow columbine, *Aquilegia chrysantha* Gray, with many *Mimulus guttatus* DC, *Rumex, Equisetum,* abundant water-cress, and with various lianas, chiefly poison-ivy and woodbine. The tree cover shading the stream is principally Arizona sycamore, *Platanus wrightii* Watson, and box-elder, *Acer negundo* L. At frequent intervals along the canyon are cold springs flowing from the slopes above the stream. Although most of the crane-flies taken were swept from the rank herbage at and near the water's edge, Sperry and I secured a number of interesting species of *Tipula* on the high dry slopes of the canyon above Todd's Lodge, where we collected to an altitude of more than 5500 feet (June 11th). Too late for inclusion in this paper, a further small series from this station was received from Professor George F. Knowlton, collected in May 1945. Upper Sonoran (Upper Austral) Life Zone.

The south rim of the Grand Canyon (Coconino Plateau), typical of the Upper Sonoran life Zone, is hot and extremely arid and hence quite unproductive of Tipulidae. The much higher north rim (Kaibab Plateau) presents a marked and pleasing contrast, supporting nearly pure stands of Western Yellow Pine, *Pinus ponderosa* Lawson, with fewer Engelmann Spruce, *Picea engelmanni* Parry, in Engelmann, similarly often growing in pure stands. Also

common are Blue Spruce, *Picea pungens* Engelmann, and White Fir, *Abies concolor* (Gordon & Glendinning). Scattered among such conifers are aspen, *Populus tremuloides* Michx., probably the commonest and most evident single tree species on the plateau. As is discussed later, the plateau lies chiefly in the Transition and Canadian Life Zones but shows a very few indicator plants of the Hudsonian Zone. As was mentioned earlier, even by mid-June, conditions on the Kaibab had become unusually dry, most of the temporary snow-fed streamlets had disappeared, and the relatively few crane-flies found were restricted to specific places. At the Kanabownits Spring, on the road to Point Sublime, on June 19th, a small stream still persisted and a few species of Tipulidae were swept from beds of *Equisetum arvense* L., *Fragaria*, *Viola* and a labiate growing beneath the spruces. In much dryer conditions, at Bright Angel Point on the North Rim, various species of the genus *Tipula* were found on the evenings of June 17 and 18, flying low over the ground beneath the growth of Western Yellow Pine, White Fir, Oak, and New Mexican Locust, *Robinia neomexicana* Gray, these including the type material of *Tipula* (*Lunatipula*) *kaibabensis* sp. nov.

Arizona has been visited by many entomologists and collectors (Bueno 1937) and certain miscellaneous specimens of Tipulidae that had been secured are to be found in various museums and collections, as discussed later in this report. I wish to express my appreciation to Mr. Douglas K. Duncan for various specimens taken in the state, especially from the Pinal Mountains, in Gila County, and at Pinery Canyon in the Chiricahuas.

Life Zones.—Of the seven life zones recognized by Merriam and his followers, no fewer than five occur commonly and are widespread in both Arizona and New Mexico. These have been thoroughly discussed in various references cited in the Bibliography (Bailey, 1913; Ball and others, 1942; Cockerell, 1895, 1897; Jenks, 1931; Dodge, 1936; Merriam & Stejneger, 1890, and others). The paper by Merriam and Stejneger, with its basic conception of the Life Zone theory, is historically the most important. For New Mexico, the Bailey reference is the most complete.

In a consideration of the Tipuloidea, the arid Lower Sonoran (Lower Austral) Zone is of little importance. Only in the Grand Canyon, along Bright Angel Creek at Phantom Ranch, altitude 2200 feet, did we find a few species of crane-flies, all being common and widespread forms. Similarly, the Upper Sonoran (Upper Austral) Zone is of slight importance except in Oak Creek Canyon, as already discussed. The Transition Zone, occupying altitudes between about 6500 and 8000 feet, characterized by Western Yellow Pine, and the Canadian Zone, between altitudes of 8000 and 9500 feet, characterized by Mexican White Pine, *Pinus strobiformis* Engelmann, White Fir, Douglas Fir, *Pseudotsuga taxifolia glauca* Mayr, aspen and many other plant species, are by far the most important zones. On the highest mountains of both states (Arizona: San Francisco Peaks, culminating in Humphreys Peak, altitude 12,611 feet; New Mexico: North Truchas Peak, altitude 13,306 feet), above the limits of the Canadian Zone, are to be found extensive bands of the Hudsonian Zone, characterized by the presence of Engelmann Spruce, the Foxtail Pine,

Pinus aristata Engelmann, and various other high altitude forms. On the highest of these mountains, a restricted Arctic-Alpine element occurs. Virtually all of the Tipulidae so far taken in Arizona and New Mexico are from the Upper Sonoran, Transition, Canadian and Hudsonian Zones.

Dice's arrangement of North America into Biotic Provinces (1943) places the area here considered in no fewer than seven of his provinces, the most easterly (Kansan) and western (Mohavian) not being significant as regards the Tipulidae. Of the others, three chiefly Mexican Provinces, the Sonoran, Apachian and Chihuahuan, are very important and are well represented in the southern parts of the states discussed. The greater part of both Arizona and New Mexico are occupied by the Navahonian Province which here attains its greatest extent. In the Taos section of northern New Mexico there is a southern prolongation of the more northern Coloradan Province, eminently characteristic of large sections of Colorado and Wyoming. By Fenneman's classification (1931) of the country into physical divisions, most of the states fall in the major division of Intermontane Plateaus, the northern part being in the Colorado Plateaus Province, the more extensive southern section in the Basin and Range Province. In the Taos section of northern New Mexico, the Southern Rocky Mountains Province of the Rocky Mountain System is represented by its southernmost extension. More than the eastern third of New Mexico is occupied by the Great Plains Province of the Interior Plains, unimportant as regards the Tipulidae.

In concluding the introduction to the present report, I wish to express my continued indebtedness to my wife, companion and loyal helpmate on all of our many collecting trips. Further appreciated help is acknowledged to my good friends, John L. and Grace H. Sperry, and Professor George F. Knowlton, whose cooperation has added materially to the success of the work.

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Systematic Account

PTYCHOPTERIDAE

Ptychoptera lenis Osten Sacken, 1877.—Summit of range between the Pecos and Sapello Rivers, New Mexico, Hudsonian zone, about 11,000 feet, August 1-4, 1900 (Cockerell, 1902; determined by Coquillett).

TIPULIDAE

TIPULINAE

Holorusia (*Holorusia*) *grandis* (Bergroth, 1888) (*rubiginosa* Loew, 1863, *nec Holorusia* (*Ctenacroscelis*) *rubiginosa* Bigot, 1863).—Oak Creek Canyon, Arizona, 5,180 ft., June 10-11, 1942; common, emerging from wet earth at the margins of stream and edges of drainage ditches. Several mating pairs noted hanging in rock crannies and overhangs near the creek.

Nephrotoma lugens erythrophrys (Williston, 1893).—Beulah, New Mexico, 8,000 ft., August 9-26, 1901 (*Skinner*); June 29, 1902 (*H. L. Viereck*).

Nephrotoma occidentalis (Doane, 1908).—Davis Mountains, Texas, along Limpia Creek, 4,000 ft., May 29, 1942; Big Bend Park, Brewster Co., July 29, 1937 (*Rollin H. Baker*).

Tipula (*Trichotipula*) *apache* Alexander, 1916.—New Mexico: Jemez Springs, 6,400 ft., July 12-20, 1915 (*Woodgate*); South Fork of Eagle Creek, White Mts., altitude about 8,000 ft., August 13 (*Townsend*).

Tipula (Trichotipula) geronimo sp. nov.—General coloration gray; antennal pedicel yellow, flagellum uniformly black, the segments moderately incised; head above chiefly yellow; praescutum brownish black, with three gray stripes; apex of knob of halteres yellow; femora obscure yellow, the tip narrowly blackened, preceded by a vague clearer yellow ring; wings creamy-white, conspicuously patterned with light and darker brown; macrotrichia of wing cells sparse, restricted to about 15 in outer end of cell R_5; *Rs* about two-thirds as long as *m-cu;* abdominal tergites broadly yellow medially, blackened on sides, the outer segments more extensively darkened; male hypopygium having the tergite with a V-shaped notch, the margin with abundant blackened spinous

setae; inner dististyle long and narrow, its outer margin with very long retrorse setae; apex of basistyle with unusually long black setae, forming a loose brush.

♂. Length, about 12 mm.; wing, 14 mm.; antenna, about 5 mm.

Frontal prolongation of head short, brown, sparsely pruinose; nasus elongate, with yellow setae; palpi black, the terminal segment paling to obscure yellow. Antennae of moderate length; scape reddish brown, sparsely pruinose; pedicel yellow; flagellum uniformly black; flagellar segments beyond the first rather strongly incised; longest verticils of the intermediate segments a trifle shorter than the segments. Head with the anterior vertex yellow, the color continued caudad onto the posterior vertex, narrowed behind, ending as a point on the occiput; remainder of posterior vertex brown, pruinose, more clearly so on the posterior orbits; vertical tubercle low and simple.

Pronotum light gray, patterned with brown. Mesonotal praescutum with the ground color brownish black, with three conspicuous gray stripes, the median one split by a capillary dark vitta on its cephalic third only; humeral region chiefly darkened; posterior sclerites of notum dark gray, the scutal lobes

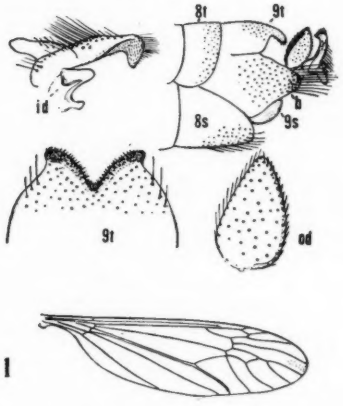

Fig. 1. *Tipula* (*Trichotipula*) *geronimo* sp. nov.; venation and male hypopygium.

(Symbols: *b*, basistyle; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite.)

weakly patterned with darker, parascutella darker. Pleura dark plumbeous gray, dorsopleural membrane weakly darkened. Halteres dusky, the base of stem and apex of knob yellow. Legs with the coxae black, sparsely pruinose; trochanters dark brown; femora obscure yellow, the tips narrowly blackened, the amount subequal on all legs; immediately before the black tips with a narrow to scarcely indicated clearer yellow ring; tibiae obscure brownish yellow, the tips narrowly brownish black; tarsi dark brown, passing into black; claws small, simple. Wings (Fig. 1), with the ground color creamy white, conspicuously clouded with dark and paler brown; the darker pattern includes the stigma, all of cell *Sc*, and broad seams over *Cu* and *m-cu*, on the former broadly interrupted by a pale ground area near outer end of cell *M*; paler brown washes in

most of cells *R* and *M* and as broad seams along the veins beyond the cord, most extensive in outer radial field; similar pale brown washes in the cubital and anal cells, the axillary border again more heavily darkened; cell *C* moderately infuscated; obliterative area before cord conspicuous, narrow but intense, barely involving cell M_3; a restricted post-stigmal obliterative marking; veins brown, paler in the obliterative areas. Macrotrichia of cells very sparse, restricted to a series of about 15 in outer end of cell R_5. Venation: Sc_2 ending about opposite two-thirds the length of *Rs*, Sc_1 preserved as a weak spur; *Rs* short, arcuated, about two-thirds as long as *m-cu*, the latter in turn about two-thirds the distal section of Cu_1; R_{1+2} preserved; cell *1st* M_2 gently widened outwardly; petiole of cell M_1 shorter than *m*.

Basal abdominal tergite black, restricted yellow on median caudal portion; second to sixth tergites broadly yellow medially, the color becoming more restricted and obscured on the outer segments; lateral portions of tergites broadly black, not quite reaching the posterior borders of the segments which are narrowly gray; outer segments more uniformly brownish black; basal sternites brownish yellow, on the sixth and succeeding segments the lateral portions broadly blackened, most extensively so on sternite eight; basistyle light yellowish brown. Male hypopygium (Fig. 1) with the suture between the tergite, *9t*, with the caudal portion produced, with a deep V-shaped median notch; lateral lobes obtuse or weakly angulated at tips; apical border thickened, set with blackened spinous setae, those near apex of lobe shorter and more abundant; toward base of notch setae more elongate, on disk with more normal setae, these lacking on nearly the cephalic half of sclerite; viewed from the side, tergal lobes appearing slightly decurved at tips. Basistyle, *b*, rather strongly produced but not differentiated into a lobe, as in some allies; apex obtuse, provided with numerous long black setae to form a loose brush. Outer dististyle, *od*, rather broadly flattened, subacute at tip; margins with numerous setae, especially the narrowly thickened cephalic border; remainder of disk with fewer but longer setae. Inner dististyle, *id*, of distinctive shape; long and narrow, the outer border with very long retrorse setae; outer portion of beak with very dense and numerous small setulae; outer basal lobe a compressed-flattened yellow blade. Mid-region of ninth sternite, *9s*, produced into a tumid oval lobe that fills the space caudad of the eighth sternite; surface of lobe with abundant very short delicate setulae. Eighth sternite, *8s*, with its caudal margin subtruncate to evenly rounded, provided with normal setae but without lobes or hair-tufts; posterior and median portions of sternite paler than the remainder.

Holotype, ♂, Chiricahua Mountains, Arizona, altitude 8,700 ft., June 5, 1942 (*C. P. & M. M. Alexander*). Taken a short distance below the Barfoot Lookout, resting on trunk of Western Yellow Pine. Several females were noted but could not be captured; flying around the pine boles in a low spiral.

Named for *Geronimo* (1834-1909), one of the most famous of all Amerind chieftains. He was leader of the Chiricahua tribe of Apache Indians, with headquarters close to the type locality of the species. The fly is very different from other regional members of the subgenus. The conspicuously patterned wings and details of the male hypopygium, particularly the basistyle and inner

dististyle, are quite different from all such species, including the one that appears to be most allied, *Tipula* (*Trichotipula*) *apache* Alexander 1916.

Tipula (Trichotipula) retinens sp. nov.—Size small (wing, female, under 12 mm.); general coloration of mesothorax light gray and yellow, the praescutum with four gray stripes that are very heavily margined with brown to produce five brown lines; frontal prolongation of head polished yellow, with a brown line on either side of median area; terminal segment of palpus paling to yellow; wings whitish subhyaline, very restrictedly patterned with darker, including the conspicuous stigma and paler washes in centers of outer radial cells; no macrotrichia in outer cells of wing; vein Sc_1 preserved; abdomen moderately long, chiefly yellow, the tergites and sternites with broken median brown stripes; ovipositor with hypovalves deep, their dorsal margins blackened.

♀. Length, about 14-15 mm.; wing, 11-11.5 mm.; antenna, about 2.3-2.4 mm.

Frontal prolongation of head polished light yellow, patterned with brown on either side of mid-dorsal line; an impressed darkened line on either side of prolongation; nasus conspicuous; palpi dark brown, the terminal segment paling to light yellow. Antennae with scape obscure yellow, weakly darkened beneath; pedicel pale brown; flagellum uniformly blackened; flagellar segments subcylindrical, a little dilated at base but scarcely incised. Head light gray, darker near mid-dorsal line, with a further capillary brown median vitta that is more expanded at apex; vertical tubercle low, with a small raised knob on either side, more conspicuous than in *bituberculata;* head on orbits and beneath more yellowed.

Pronotum yellow, with three brownish gray spots. Mesonotal praescutum with the humeral and lateral borders light yellow, the disk with four gray stripes that are so broadly bordered by dark brown that the latter fills all the interspaces, the median dark vitta not reaching the suture behind; scutum with median area light yellow, the lobes with gray spots that are ringed with brown; scutellum at base narrowly yellow, the remainder gray, with a very conspicuous dark brown median mark that is narrowed in front; parascutella yellow, narrowly infuscated at suture; mediotergite light gray, the lateral borders and a broad central stripe light yellow; pleurotergite light yellow, the ventral katapleurotergite gray. Pleura yellow, conspicuously patterned with gray, including major areas on ventral anepisternum, sternopleurite and meron; dorsopleural membrane yellow, with a dark spot beneath the pseudosutural fovea. Halteres with stem yellow, knob brown, its tip restrictedly yellow. Legs with the coxae gray, the tips yellow, the mid-coxae more extensively brightened; trochanters obscure yellow; femora and tibiae obscure yellow, the femoral tips narrowly but conspicuously dark brown, the tibiae less evidently so; basitarsi brownish yellow, the outer end and remainder of tarsi blackened. Wings whitish subhyaline, very restrictedly patterned with darker, the most conspicuous area being the oval, medium brown stigma; other darkenings include very pale brown washes in centers of cells R_2, R_3 and R_5, with exceedingly vague clouds in outer end of cell *1st A* and near outer end of cell *Cu;* outer medial veins very narrowly bordered by pale brown; cell *Sc* weakly darkened; veins dark brown,

a trifle more brightened in the prearcular field. No macrotrichia in cells of wing, excepting a very few in the stigma of the holotype but not of the paratype; no squamal trichia. Venation: Sc_1 preserved, a little shorter than the basal section of Sc_2; *Rs* subequal to the long oblique or weakly sinuous *m-cu;* petiole of cell M_1 slightly longer than *m*.

Abdomen of moderate length only, when compared with *cahuilla,* about as long as the wing; tergites light yellow, with a broken median brown stripe, these areas being interrupted at the base and apex of the individual segments, the posterior borders being narrowly gray; sternites yellow, the more proximal ones with more extensive median darkenings, particularly the base of second sternite, on outer segments, the sternites more uniformly yellow; a median dark dash on genital sternite, with a further area at base of hypovalvae. Ovipositor with the genital shield brown; cerci moderately compressed, the tips subacute; hypovalves much deeper, the tips subacute, the dorsal border heavily blackened.

Holotype, ♀, Coolidge, Pinal County, Arizona, altitude 2,000 ft., April 1 (*D. K. Duncan*). *Paratopotype,* 1 ♀. "On desert flat country, with no nearby mountains."

Although no male is available, I have no hesitancy in describing this fly as new and in referring it to the subgenus *Trichotipula* Alexander, despite the lack of macrotrichia in the wing cells. The relationship to *Tipula* (*Trichotipula*) *beatula* Osten Sacken, *T.* (*T.*) *bituberculata* Doane and *T.* (*T.*) *cahuilla* Alexander, all of California, seems obvious. The thoracic pattern, including the darkened line on the scutellum and the pale central mark on the mediotergite, closely approximates the type of pattern found in *beatula* but otherwise the flies are not particularly close. The retention of vein Sc_1 in the present fly is noteworthy, since it is lacking in virtually all other known species of the genus, including the various allies above listed.

Tipula (*Bellardina*) *albimacula* Doane, 1912.—Arizona, with no further data (Doane's type).

Tipula (*Bellardina*) *pura* Alexander, 1941.—Rio Ruidoso, White Mountains, New Mexico, 7,500 ft., May 31, 1942; along small mountain stream, in shade of Douglas Fir.

Tipula (*Bellardina*) *rupicola* Doane, 1912.—Described by Doane from a single male taken in Oak Creek Canyon, Arizona. I secured a number of specimens of a very similar *Bellardina* at this same place, 5,180 ft., June 10-12, 1942, but cannot reconcile the structure of the dististyles of the male hypopygium with Doane's somewhat detailed description. The same species has been taken in New Mexico: Jemez Springs, 6,400 ft., June 7 (*Woodgate*); Frijoles Canyon, Bandelier National Monument, September 8, 1941 (*Sperry*). Comparison with Doane's type will be necessary to verify this determination.

Tipula (*Bellardina*) *schizomera* Alexander, 1940.—Dripping Springs, near Austin, Texas, May 17, 1924 (*R. H. Painter*). Described from Chiapas, southern Mexico; known also from southern Utah.

Tipula (*Yamatotipula*) *meridiana* Doane, 1912.—Arizona, with no further data (Doane's type). Common in Utah.

Tipula (*Yamatotipula*) *vicina* Dietz, 1917.—Frijoles Canyon, Bandelier National Monument, June 18, 1942 (*Sperry*).

Tipula (*Oreomyza*) *clathrata* Dietz, 1914.—Jemez Springs, New Mexico, 6,400 ft., August 14, 1913 (*John Woodgate*); part of type material.

Tipula (*Oreomyza*) *doanei doanei* Dietz, 1914.—Jemez Springs, New Mexico, 6,400 ft., July-August 1913 (*John Woodgate*); type material.

Tipula (*Oreomyza*) *doanei bifida* Dietz, 1914.—Jemez Springs, New Mexico, 6,400 ft., August 9-22, 1913 (*John Woodgate*); types.

Tipula (*Oreomyza*) *serta* Loew, 1863 (*albonotata* Doane, 1901).—Frijoles Canyon, Bandelier National Monument, June 19, 1942 (*Sperry*).

Tipula (Eumicrotipula) chiricahuensis sp. nov.—Belongs to the *virgulata* group; general coloration of mesonotal praescutum yellowish gray, with four dark brown stripes; antennae (male) relatively long, conspicuously bicolored, the basal flagellar segments yellow with brownish black bases; femora obscure brownish yellow, the tips brownish black, preceded by a vague clearer yellow ring; wings yellowish subhyaline, conspicuously patterned with brown and more whitish subhyaline; abdomen reddish, with three more or less distinct brownish black stripes on the basal tergites; male hypopygium with the caudal margin of tergite having a deep median split, the broad lateral lobes unequally divided into lobules by more shallow sublateral emarginations; a single tripartite dististyle; eighth sternite transverse, the posterior border bearing a small oval lobe.

♂. Length, about 15 mm.; wing, 17-17.5 mm.; antenna, about 5.5-6.2 mm.

♀. Length, about 28 mm.; wing, 20 mm.; abdomen alone, about 23 mm.

Frontal prolongation of head yellowish brown, more pruinose above; nasus distinct; palpi black. Antennae of male relatively long, variable in length, the shortest measurement given above being that of the type; scape, pedicel and first flagellar segment obscure yellow, succeeding six or seven segments with the basal enlargements brownish black, the apical stems conspicuously yellow; outer segments uniformly dark brown or brownish black; terminal segment very reduced; flagellar segments moderately incised, longer than the verticils. Head dark gray, the vertex with three more or less distinct brown lines, the suborbitals wider than the median vitta; front and narrow posterior orbits clear gray; vertical tubercle small and simple.

Pronotum brown, gray pruinose, dark brown medially. Mesonotal praescutum yellowish gray pruinose, with four dark brown stripes; in female, the ground color more strongly yellowed, the stripes more reddish brown but clearly delimited; vestiture of interspaces very small and sparse, scutum brownish gray, the lobes vaguely patterned with darker; scutellum gray pruinose, paler behind, parascutella even darker; postnotum blackened, pruinose, with a more or less distinct dark median stripe. Pleura and pleurotergite gray pruinose; dorsopleural membrane chiefly pale in front, infuscated behind. Halteres with stem yellow, knob infuscated. Legs with coxae brown, gray pruinose; trochanters yellow; femora obscure brownish yellow to pale brown, the tips narrowly

dark brown or brownish black, preceded by a vague clearer yellow ring; tibiae reddish brown, the tips narrowly black; tarsi passing into black; claws simple. Wings (Fig. 2) yellowish subhyaline, conspicuously patterned with brown, the dark color exceeding in amount the pale ground; cell *C* brownish yellow, a little paler than *Sc;* ground areas beyond the stigma in cells R_2 and R_3; at ends of cells R_5 to M_3, inclusive, becoming more restricted behind; obliterative band across cell *1st* M_2 and adjoining cells and a large spot at two-thirds the length of cell *M* clearer yellowish white; basal portions of cells *R, M, Cu* and the Anals extensively pale; cell *Cu* chiefly pale, variegated by two brown areas at near midlength; cell *1st A* with a more or less evident zigzag pale pattern at near midlength; prearcular field chiefly dark; veins brown, the obliterative sections extensive. In female, the light and dark patterns are even more contrasted. Squama naked. Venation: *Rs* long, about one and one-half times as long as *m-cu;* R_{1+2} preserved; petiole of cell M_1 subequal to *m;* cell *2nd A* wide.

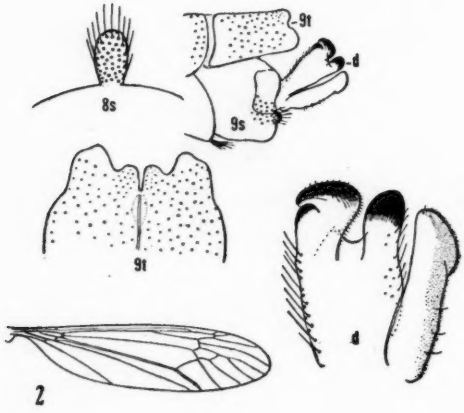

Fig. 2. *Tipula* (*Eumicrotipula*) *chiricahuensis* sp. nov.; venation and male hypopygium. (Symbols: *b,* basistyle; *d,* dististyle; *s,* sternite; *t,* tergite.)

Abdomen reddish, on basal tergites in male with three more or less distinct brownish black stripes, these becoming obsolete beyond the third or fourth segments; posterior borders of outer segments obscure yellow, the extreme lateral borders of tergites broadly pale. In female, abdomen elongate, the outer sternites faintly pruinose. Ovipositor with cerci unusually long and straight, smooth. Male hypopygium (Fig. 2) with the ninth tergite, *9t,* separated from the ninth sternite, *9s;* basistyle more or less rectangular in outline, completely delimited. Ninth tergite, *9t,* entirely pale, large, the total length about equal to the breadth; caudal margin with a deep and narrow median notch; each broad lateral lobe thus formed divided by a broader and shallower notch into a small mesal lobule and a broader and larger outer one; dorsal surface of tergal plate with relatively numerous scattered setae, these becoming very small and delicate on the mesal lobule, lacking on outer margin of lateral lobule.

Ninth sternite divided medially beneath by pale membrane; ventro-mesal angle with a small oval setiferous appendage lying immediately ventrad of the basistyle; cephalic portion of sternite glabrous. Apparently a single dististyle, *d*, the main mass of which terminates in two flattened and blackened lobes, of which the usual beak-like portion is the larger; outer basal lobe, *obl*, a little shorter than the main mass of the style, nearly parallel-sided on more than the basal half, thence weakly dilated, the apex obtuse; outer surface of lobe with an abundance of delicate setulae. Eighth sternite, *8s*, relatively short, transverse; caudal margin bearing a relatively small, short-oval, setiferous median lobe; longest setae of lobe only a little shorter than the appendage itself; main body of sternite without setae.

Holotype, ♂, Pinery Canyon, Chiricahua Mountains, Arizona, 6,200 feet, July 22 (*D. K. Duncan*). *Allotopotype*, ♀, pinned with type. *Paratopotype*, 1 ♂, August 7.

I am referring this fly to the subgenus *Eumicrotipula* Alexander, represented by a host of species in Tropical America but not hitherto found north of the Mexican Boundary. Superficially the fly somewhat resembles *Tipula* (*Lunatipula*) *dorsimacula* Walker, 1848.

Tipula (Hesperotipula) coronado sp. n.—Belongs to the *streptocera* group; praescutal stripes and centers of scutal lobes polished black; outer cells of wing grayish yellow, with conspicuous pale brown central areas; abdomen with the median tergal stripe entire or nearly so, the sublateral stripes broken into triangles on the bases of tergites three to seven, inclusive; male hypopygium with the tergal notch broadly V-shaped; apex of inner dististyle broadly obtuse; arm of basistyle relatively slender; apex of eighth sternite with the usual two lateral hair brushes, together with a small median group.

♂. Length, about 12.5-13 mm.; wing, 14-15 mm.; antenna, about 4.2-4.4 mm.

♀. Length, about 13-14 mm.; wing, 14-15 mm.

Frontal prolongation of head brownish black; nasus distinct; palpi black. Antennae with the scape, pedicel and first flagellar segment testaceous yellow, succeeding segments dark brown; flagellar segments moderately incised, a little exceeding the longest verticils. Head brownish black, very sparsely gray pruinose, more heavily so on the front and very narrow orbits; anterior vertex moderately wide, about three times the diameter of scape.

Pronotum blackened medially above, paling to obscure yellow on sides. Mesonotum obscure yellow, the praescutum with three very conspicuous polished black stripes, the lateral pair straight; each scutal lobe with a large polished black area; scutellum and mediotergite more brownish yellow to brown, the former even darker medially, the latter with paired blackened areas on posterior third; pleurotergite obscure yellow, the katapleurotergite weakly infuscated, especially near the root of the haltere. Pleura obscure yellow to reddish yellow, the surface polished; dorsopleural membrane yellow. Halteres with stem yellow, knob brownish black. Legs yellow, femora and tibiae with tips very narrowly but conspicuously brownish black to black; tarsi passing into

black; claws toothed. Wings with the ground color grayish yellow, the prearcular and costal fields clearer yellow; stigma oval, dark brown; a small, dark brown cloud over origin of *Rs;* centers of all cells beyond cord and outer ends of the more basal cells with pale brown centers; obliterative areas relatively small and inconspicuous; veins brown, yellow in the brightened fields. Venation: *Rs* relatively long, fully three times the short *m-cu;* M_{3+4} shorter than the basal section of M_{1+2}.

Abdomen reddish yellow, the tergites with a broad median black stripe, continuous or more or less broken by the pale posterior margins of the segments, these latter increasing in degree on the outer segments; tergites three to seven, inclusive, each with a conspicuous blackened triangle on basal portion, the outermost one smallest; lateral tergal margins grayish yellow; sternites yellow; hypopygium obscure orange to light castaneous. Ovipositor with the small fleshy valves of the subgenus. Male hypopygium (Fig. 3) with the ninth

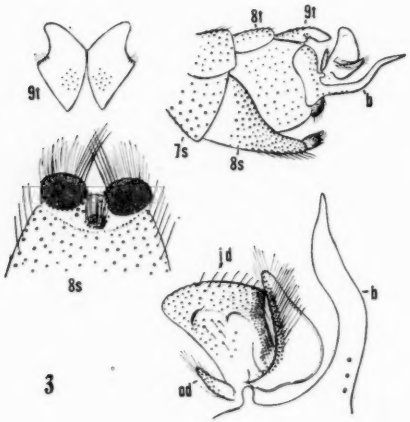

Fig. 3. *Tipula* (*Lunatipula*) *coronado* sp. nov.; male hypopygium.
(Symbols: *b*, basistyle; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite.)

tergite, *9t*, small, the posterior half separated from the sternite by a conspicuous suture; basistyle, *b*, long and narrow, its suture delimited but delicate. Ninth tergite, *9t*, viewed from above with a very broad V-shaped emargination, the lateral lobes thus formed strongly divergent, obtusely rounded at tips, glabrous; as in other members of the subgenus, the tergite more or less distinctly divided into a posterior half, as described, and a triangular cephalic portion that is closely united with the sternite; posterior portion of tergite with a few longer setae on lateral margins of lobes and with a few small scattered setulae on disk; cephalic portion of tergite with small but conspicuous setae. Ninth sternite with a small but evident bilobed appendage at its caudo-mesal portion, this fringed with very long conspicuous setae. Basistyle, *b*, with its posterior border produced outwardly into a long slender rod, directed caudad and thence more dorsad, the tip subacute; a very few long setae near base of rod; posterior

margin of basistyle dorsad of this arm bearing a small oval lobe. Outer dististyle, *od*, a small terete dark-colored lobe, narrowed outwardly, provided with elongate setae. Inner dististyle, *id*, massive and compact; outer basal lobe conspicuous, its base and disk glabrous, the margins and apex with long delicate setae. Eighth sternite, *8s*, strongly sheathing, narrowed outwardly, at apex with two semi-detached darkened lobes and a smaller median tuft or brush of setae; lateral lobes with the flattened outer surface densely covered with long crenulate setae that terminate in hairlike points; near mesal portion of each lobe with about six much longer and stronger setae; setae of median tuft relatively long and stout, their outer portions appearing as pale flattened blades.

Holotype, ♂, Oak Creek Canyon, Arizona, altitude 5,180 ft., June 10, 1942 (*C. P. Alexander*). *Allotopotype*, ♀, with the type. *Paratopotypes*, numerous ♂ ♀, June 10-12, 1942 (*Alexander & Sperry*).

Named for Francisco Vásquez Coronado, Spanish explorer, whose proposed conquest of the "Seven Cities of Cíbola" and subsequent explorations to the north, 1540-1541, must have gone close to the type locality of the present species. The fly is readily told from the other members of the subgenus *Hesperotipula* Alexander (type, *streptocera* Doane, 1901) by the coloration and, especially, by the structure of the male hypopygium, particularly the ninth tergite and inner dististyle. When Dietz reviewed the species of this group (Ann. Ent. Soc. America, 12:85-94; 1919), he included *translucida* Doane, 1901 (*devia* Dietz) and *pleuracicula* Alexander, 1915 (*monochroma* Dietz), which belong to the subgenus *Lunatipula* Edwards. As now restricted, *Hesperotipula* is a compact group, with relatively numerous species in extreme western North America.

Tipula (Lunatipula) buenoi sp. nov.—Size medium (wing, male, not exceeding 15 mm.); mesonotum light gray, the praescutum with four medium brown stripes; pleura and pleurotergite variegated light gray and yellow, the latter color particularly evident behind; femora and tibiae brownish yellow, the tips undarkened; claws (male) toothed; wings weakly tinged with brown, very restrictedly patterned with darker brown, including a vague seam along vein *Cu*; abdominal tergites obscure yellow, with three poorly indicated darker stripes, the lateral borders broadly yellow; male hypopygium with the tergite brown, bordered by light yellow; posterior border broadly emarginate, with conspicuous lateral lobes and a broad median prolongation; inner dististyle with the beak coarsely ribbed longitudinally, the outer basal lobe thin and membranous, scoop-like, the margin produced into a powerful spine; gonapophyses deeply bifid.

♂. Length, about 10-11 mm.; wing, 11-12.5 mm.; antenna, 3.6-4 mm. A paratype male from New Mexico is larger,—Length of body and wing, 15 mm.

♀. Length, about 13-16 mm.; wing, 11-13.5 mm.

Frontal prolongation of head brownish yellow; nasus short; palpi obscure brownish yellow, the terminal segment blackened. Antennae with scape and pedicel light yellow, flagellum black; flagellar segments gently incised, the intermediate segments more strongly so; verticils of the intermediate segments

a little shorter than the segments. Head above light gray, more yellowed behind; a delicate brown median stripe is sometimes evident, extending from the low vertical tubercle onto the posterior vertex.

Pronotum light gray, with three brown spots, the median one more distinct. Mesonotum light gray, the praescutum with four medium brown or reddish brown stripes, the intermediate pair darker, narrowed behind, the median gray vitta correspondingly widened; humeral region of praescutum abruptly light yellow, concolorous with the pretergites and dorsopleural membrane; scutum with median region restrictedly yellow, the posterior lateral angles of the lobes more obscure yellow, the remainder gray, each lobe with two brown areas; scutellum and mediotergite lighter gray, the latter with indications of a capillary dark central vitta; lateral borders of mediotergite and much of the pleurotergite yellow. Pleura light gray, conspicuously variegated with light yellow,

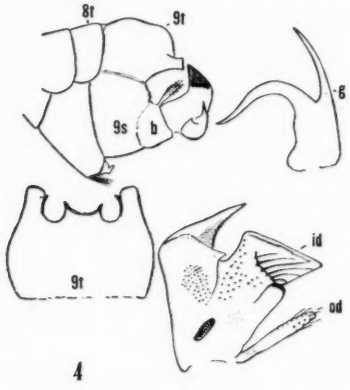

Fig. 4. *Tipula* (*Lunatipula*) *buenoi* sp. nov.; male hypopygium.
(Symbols: *b*, basistyle; *g*, gonapophysis; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite.)

particularly on the mesepimeron and metapleura. Halteres with stem obscure yellow, clearer basally, knob dark brown, indistinctly paler at tip. Legs with coxae gray pruinose; trochanters yellow; femora and tibiae obscure brownish yellow, the tips not darkened; barsitarsi obscure yellow, the tips and remainder of tarsi dark brown; claws (male) toothed. Wings with a weak brownish tinge, the prearcular and costal fields, with the stigma, more saturated yellow to light brown; a broad but vague darkened seam along vein *Cu*, chiefly in cell M; obliterative areas poorly indicated; veins brown. Squamal setae elongate. Venation: Sc_1 atrophied; Rs varying from slightly more than two to about two and one-half times *m-cu*; R_{1+2} strongly preserved; petiole of cell M_1 much longer than *m*; *m-cu* at or before the fork of M_{3+4}.

Abdominal tergites obscure yellow, gray pruinose, especially on the basal tergites; three poorly indicated darker stripes; lateral borders broadly yellow, delimited internally by the sublateral dark stripes; sternites obscure yellow; hypopygium with tergite chestnut brown, the lobes and borders light yellow; remainder of hypopygium chiefly light yellow, the cephalic portion of the ninth

sternite again darkened. Ovipositor with cerci well-developed, blackened, margins smooth, the tips obtuse; hypovalvae small and weak, yellow. Male hypopygium (Fig. 4) with the tergite, *9t*, moderately enlarged, entirely separated from the sternite, *9s*, by a deep suture; basistyle indicated on its ventral half, the remainder merely depressed. Ninth tergite, *9t*, large, the posterior border broadly emarginate, the conspicuous lateral lobes flattened and truncated at their tips; median area likewise produced into a broad low lobe, the lateral angles of which are produced into small compressed blades that appear as acute points when viewed from above; lateral lobes separated from the median extension by deep rounded notches; on ventral surface of lateral lobes with an acute blackened tooth, normally directed mesad; in cases, a further longer and more slender spine on ventral surface closer to midline, this sometimes lacking. Ninth sternite, *9s*, large, near the cephalic portion on either side with a small flattened glabrous blade that is directed outward; fleshy appendages small, provided with very long setae. Basistyle not produced. Outer dististyle, *od*, small, cylindrical, entirely pale. Inner dististyle, *id*, compact, the beak darkened, triangularly pointed, coarsely ribbed longitudinally; lower beak small; outer basal lobe very large, thin and scoop-like, one angle produced into a strong spine, directed outward and setuliferous almost to the acute apex; in cases, the opposite outer angle of the plate is produced into a second smaller point, this sometimes lacking; sensory area conspicuous, placed near base of style. Gonapophyses, *g*, broad basally, split into two arms, the more mesal one nearly straight, the stronger and more powerful lateral arm a curved horn. Eighth sternite, *8s*, moderately sheathing, at apex with both the low median cushion and the lateral lobes set off from the main body of the sclerite by pale membrane; median cushion weakly divided at midline, provided with two brushes of moderately long setae that are weakly decussate at the midline; lateral lobes irregular in outline, the mesal-apical portion more or less produced into a more flattened blade; apex of lobe unusually glabrous, there being only 5 or 6 scattered setae of various lengths.

Holotype, ♂, Coolidge, Pinal County, Arizona, 2,000 ft., April 1 (*D. K. Duncan*). *Allotopotype*, ♀, with the type. *Paratopotypes*, 6 ♂ ♀, with the type. *Paratypes*, 1 broken ♂, Tucson, Arizona, May 1942 (*Bueno*), in porch light of Bueno home; 1 ♂, Valentine, Arizona, May 10, 1945 (*G. F. Knowlton*); 1 ♂, Picacho, Arizona, March 24, 1945 (*G. F. Knowlton*); 1 ♂, Socorro, Socorro County, New Mexico, from the Williston Collection, through Aldrich; U.S.N.M.

This interesting species is named for my good friend, Mr. J. R. de la Torre-Bueno, of Tucson, world authority on the Hemiptera-Heteroptera. I am unable to point out any very closely allied species. The shape of the tergite is somewhat as in the otherwise quite different *Tipula* (*Lunatipula*) *stalagmites* Alexander, 1915.

Tipula (*Lunatipula*) *barbata* Doane, 1901.—Southern Arizona, without more exact data, August 1902 (*F. H. Snow*); Univ. Kansas.

Tipula (*Lunatipula*) *dorsimacula* Walker, 1848 (*angustipennis* Loew, 1863).—Pinal Mountains, Gila County, Arizona, 8 miles south of Globe, 5,000 ft., along flowing stream in Sulphide Del Rey Canyon (*D. K. Duncan*).

Tipula (Lunatipula) incisa queres subsp. nov.—

♂. Length, about 14.5-16 mm.; wing, 14-16.5 mm.; antenna, 4-4.2 mm.

Frontal prolongation of head yellow, sparsely pruinose at base above, relatively stout, subequal in length to remainder of head; no nasus; palpi with basal segment obscure yellow, segments two and three more obscured, the relatively short terminal segment brownish black. Antennae with scape and pedicel yellow; first flagellar segment reddish yellow, weakly darkened at tip, remaining segments black; flagellar segments with basal enlargements moderately developed; longest verticils subequal in length to the segments; first flagellar segment short, about as long as the second. Head yellowish gray, the posterior vertex with a capillary blackened median vitta; vertical tubercle low and ill-defined.

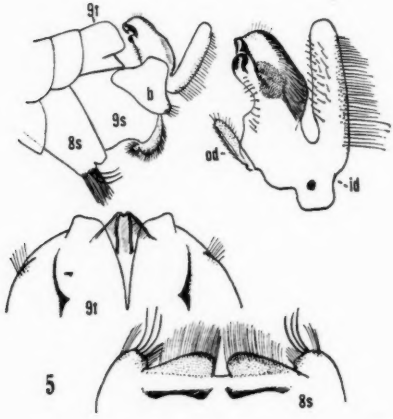

Fig. 5. *Tipula* (*Lunatipula*) *incisa queres* subsp. nov.; male hypopygium.

(Symbols: *b*, basistyle; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite.)

Pronotum brownish gray, variegated with slightly darker markings. Mesonotal praescutum gray, with five more or less distinct darker brown lines that represent the borders of the stripes; median stripe more infuscated, with three of the dark lines, including the lateral borders and a much more or less evident median vitta; lateral stripes indicated by a slightly wider brown line; posterior sclerites of notum brownish gray, each scutal lobe with two light brown areas, the median portion of scutum yellow in front. Pleura brownish yellow, very sparsely pruinose; dorsopleural membrane more yellowed. Halteres with stem yellow, knob more infuscated. Legs with coxae pale, sparsely pruinose; trochanters yellow; femora and tibiae yellow, the tips narrowly dark brown; basitarsi obscure yellow, the outer tarsal segments passing into black; claws (male) toothed. Wings brownish gray, restrictedly patterned with brown and whitish subhyaline; prearcular field very pale yellow; cells *C* and *Sc*, especially the latter, deeper yellow; the brown pattern includes the pale brown stigma and restricted darker clouds at tip of *Sc*, origin of *Rs*, over the anterior cord, and a linear cloud in cell *Cu* before midlength; obliterative area before cord exten-

sive, particularly in cells *R* and R_1, the color recurring before origin of *Rs* and as a seam backward along vein *M;* a restricted post-stigmal brightening, with other pale areas before and beyond the darkened cloud in cell *Cu;* veins brown, more yellowed in the brightened fields. Venation: *Rs* somewhat less than twice *m-cu;* R_{1+2} entire; petiole of cell M_1 subequal to or shorter than *m*.

Abdomen with tergites yellow, with three dark stripes, the median one broader but paler, very narrowly interrupted at the posterior borders of the segments; sublateral dark stripes much broken, best indicated on cephalic half of segments; lateral tergal borders broadly pale; sternites more uniformly yellow; hypopygium relatively large, brownish yellow. Male hypopygium (Fig. 5) having the ninth tergite separate from the sternite; basistyle, *b*, entire. Ninth tergite, *9t*, transverse, the sides deflexed; lateral lobes low and irregular, near the midline somewhat further expanded into a flattened flange, its outer edge obliquely truncate; a broad-based, more sclerotized median tooth that bears two subparallel carinae down the face; on either side of body of sclerite, on ventral surface, with a strong sclerotized supporting flange, near its cephalic portion produced mesad into a strong spinous point. Ninth sternite, *9s*, with the appendage very large and pendant, conspicuously bilobulate, the upper portion large and tumid, with coarse setae, the small apical lobule with a separate grouping of long delicate setae. Basistyle, *b*, large, entire, its upper portion produced dorsad into a low flattened plate or lobe that overlies the bases of the dististyles; posterior lower angle slightly produced into an obtuse lobe that bears a few strong setae. Outer dististyle, *od*, small, the blade slightly expanded. Inner dististyle, *id*, deeply bilobed, the main body with the beak blackened and shaped more or less like an arch or horseshoe, the concave portion adjacent to the suboval blackened lower beak; dorsal crest low, subhyaline, the margin microscopically serrulate, the surface obliquely striate; body of style at base of crest with abundant close-set microscopic areas to produce a more or less tesselated appearance; outer basal lobe erect, directed dorsad, appearing as a flattened elongate lobe that is nearly as long as the style itself, its length exceeding four times its diameter at midlength, the apex glabrous, obtusely rounded; the entire posterior or lower surface of lobe with abundant erect pale setae, those nearest the base longest. Eighth sternite, *8s*, relatively short but sheathing, the apex unusually broad, with short obtuse lateral lobes that are provided with about three major setae and rather numerous smaller normal ones; median portion of caudal border extensive, with two low tumid lobes, lowest on sides, high and steep on their mesal portion adjoining the slight median space; entire lobe densely clothed with long yellow setae.

Holotype, ♂, Frijoles Canyon, Bandelier National Mounment, New Mexico, June 19, 1942 (*Sperry*). *Paratopotypes*, 2 ♂♂, June 19-21, 1942.

The subspecific name is that of an Amerind tribe formerly inhabiting the Frijoles Canyon. I am considering this fly as representing a race of *Tipula* (*Lunatipula*) *incisa* Doane, 1901, still known only from the Pacific Northwest. It further appears that *eriensis* Alexander, 1943, and *kansensis* Alexander, 1918, of the Prairie and Central Plains section of North America, should likewise be considered as being races of *incisa*. All of the above have the structure of the male hypopygium generally the same but differ in the colora-

tion of the body and wings. The lack of a nasus in this species is somewhat noteworthy but it may be stated that rather numerous members of the subgenus in the western Nearctic Region are known to lack this structure.

Tipula (*Lunatipula*) *polycantha* Alexander, 1942.—Frijoles Canyon, Bandelier National Monument, New Mexico, June 22, 1942 (*Sperry*); type. Oak Creek Canyon, Arizona, 5,180-5,300 ft., June 10-12, 1942 (*Alexander & Sperry*).

Tipula (*Lunatipula*) *stalagmites* Alexander, 1915.—Dripping Spring, Organ Mountains, New Mexico, at light , April 23, 1898 (*T. D. A. Cockerell*); type, U.S.N.M. 19,982.

Tipula (Lunatipula) coconino sp. nov.—Belongs to the *impudica* group; size medium (wing, male, about 15 mm.); general coloration of thorax gray, the praescutum with four narrow dark brown stripes, the interspaces with black setigerous punctures; femora brownish yellow, the tips narrowly blackened; wings with a brownish tinge, restrictedly patterned with darker brown and whitish subhyaline; abdomen yellow, the tergites with three brown stripes, the median one barely defined, the sublateral pair distinct and but narrowly interrupted; male hypopygium having the tergal canthi moderately long, their tips obtuse, the lateral processes unusually small, appearing as blackened blades; median tergal blade compressed, its apex unusually narrow and pale, without fimbriations; inner dististyle with the outer basal lobe darkened, relatively small, slightly more than one-half the remainder of style; apex of lower beak with microscopic teeth.

♂. Length, about 16 mm.; wing, 15-15.5 mm.; antenna, about 4.2-4.3 mm.

♀. Length, about 19 mm.; wing, 15 mm.

Frontal prolongation of head reddish brown, narrowly darker and pruinose above; a narrow, still darker lateral vitta; nasus long; palpi brownish black, the terminal segment black, relatively short. Antennae with scape and pedicel yellow, flagellum with basal segment brownish yellow, remainder of flagellum black, the segments moderately incised. Head brownish gray, the vertex with a conspicuous capillary black median line.

Pronotum brownish gray, the pretergites and adjacent areas yellowed. Mesonotal praescutum with a broad gray median stripe that is bordered by narrower dark brown stripes that are slightly narrower and more convergent on posterior half; lateral stripes similarly dark brown, relatively narrow; interspaces a little lighter gray, with conspicuous black setigerous punctures, the humeral area a trifle more buffy; posterior sclerites of notum gray, the scutal lobes variegated with dark brown; central portion of scutellum more infuscated. Pleura and pleurotergite gray, the dorsopleural region yellow. Halteres with stem obscure yellow, knob blackened. Legs with the coxae light brown or yellowish brown, sparsely pruinose; trochanters obscure yellow; femora and tibiae brownish yellow, the tips narrowly blackened, the latter more narrowly so; tarsi black, the proximal portions of basitarsi more brightened; claws toothed. Wings with a brownish tinge, cell *Sc* more brownish yellow, more heavily infuscated in outer radial field and as a broad seam along *m-cu;* vein *Cu* not seamed with darker; prearcular field more brightened; stigma large, darker brown; oblitera-

tive areas before and beyond the stigma, the former small, disconnected from a larger mark across cell *1st* M_2 into base of cell M_3 and adjacent portions of M_4; veins brown. Venation: *Rs* about twice *m-cu*.

Abdomen with the first tergite gray pruinose, more infuscated on sides; succeeding segments yellow, the tergites with a narrow but conspicuous, nearly continuous, dark brown sublateral stripe, on the outer segments these narrowly interrupted by pale posterior borders of the segments; a much less distinct and broken median vitta; lateral tergal margins broadly pale; sternites yellow, in the female more darkened medially; hypopygium brownish yellow, patterned with darker brown. Male hypopygium (Fig. 6) with the ninth tergite, *9t*, having the median blade (subtergal process) relatively narrow, compressed, its apex unusually pale and narrow, without fimbriations; canthi appearing as moderately long flattened blades, the tips obtuse and with the margins microscopically crenulate; lateral tergal processes unusually small, appearing as narrow blackened blades, their tips subacute. Ninth sternite with the appendage very strongly bilobed, the major upper portion provided with slender erect black setae, the small suboval lower end with shorter, stout reddish bristles. Outer

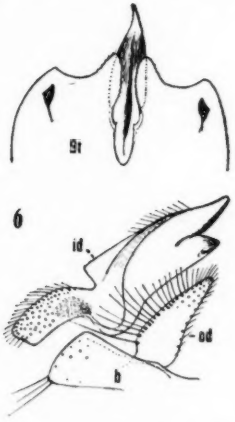

Fig. 6. *Tipula* (*Lunatipula*) *coconino* sp. nov.; male hypopygium.

Symbols: *b*, basistyle; *id*, inner dististyle; *od*, outer dististyle; *t*, tergite.)

dististyle, *od*, unusually wide for a member of this group; upper margin fringed with long black setae. Inner dististyle, *id*, with both the beak and lower beak heavily blackened, separated from one another by a V-shaped emargination; apex of lower beak with microscopic teeth; dorsal crest pale, not narrowed and produced posteriorly, the apical portion with a few microscopic denticles; outer basal lobe darkened, relatively small, slightly more than one-half the length of the body of the style, fringed with long conspicuous setae.

Holotype, ♂, Williams, Arizona, June 11, 1941 (*J. & G. Sperry*). *Allotopotype*, ♀, pinned with type. *Paratopotype*, 1 ♂.

Most similar to species such as *Tipula* (*Lunatipula*) *mitrata* Dietz, 1921, from which it differs most evidently in the structure of the male hypopygium.

Tipula (*Lunatipula*) *diversa* Dietz, 1921.—Silver City, Grant County, New Mexico, May 24-30, 1913; part of type series.

Tipula (*Lunatipula*) *dimidiata* Dietz, 1921.—Silver City, Grant County, New Mexico, June 1, 1911; type.

Tipula (Lunatipula) kaibabensis sp. nov.—Belongs to the *impudica* group; size medium (wing, male, about 15 mm.); general coloration of thorax gray, variegated with four narrow reddish brown praescutal stripes; abdomen chiefly yellow, with lateral brown dashes on basal tergites; wings light brown, restrictedly patterned with slightly darker brown and more yellowish subhyaline areas, the latter including a small post-stigmal brightening and a relatively inconspicuous band at cord; male hypopygium having tergite with canthi long, their tips obtuse, lateral processes large, heavily sclerotized; median blade compressed, the dorsal surface at apex microscopically fimbriate; basistyle unproduced; inner dististyle with both the beak and lower beak blackened, stout; outer basal lobe relatively small; eighth sternite with an uninterrupted fringe of long yellow setae across the caudal border; from the membrane above the sternite with a slender pale fleshy lobe.

♂. Length, about 13.5-15 mm.; wing, 13.5-15.5 mm.; antenna, about 4.8-5.1 mm.

Frontal prolongation of head subequal to or a little longer than the remainder of head, fulvous yellow, sparsely pruinose at base; nasus lacking or reduced to a microscopic tubercle; palpi with basal two segments yellowish brown, the outer segments brownish black. Antennae with scape and pedicel light yellow; first flagellar segment chiefly yellow, restrictedly patterned with darker on ventral aspect; succeeding segments weakly bicolored, the basal enlargement black, the remainder dark brown, the outer segments more uniformly brownish black; flagellar segments rather conspicuously incised; verticils shorter than the segments. Head above brownish gray, with indications of a capillary darker brown median vitta.

Prothorax pale brown, sparsely pruinose. Mesonotal praescutum with the ground color gray, with four narrow, more reddish brown stripes, the intermediate pair constituting the narrow lateral borders of a broad more brownish gray median stripe, these borders more distinct behind; scutal lobes and bases of the scutellum gray, weakly patterned with reddish brown; mediotergite gray, with a vague central reddish brown line. Pleura brownish yellow, sparsely pruinose, vaguely patterned with somewhat darker areas; dorsopleural membrane yellow. Halteres with stem obscure yellow, knob infuscated. Legs with the coxae pale, sparsely gray pruinose; trochanters yellow; femora yellow, the tips narrowly blackened; tibiae similar with the tips even more narrowly darkened; tarsi at base obscure yellow, the broad tips of basitarsi and remaining segments black; claws (male) toothed. Wings with the ground light brown, restrictedly patterned with slightly darker brown and more yellowish subhyaline areas; prearcular and costal fields more brownish yellow; stigma darker brown; outer radial field somewhat deeper brown than the remainder of ground; obliterative areas including a small but conspicuous post-stigmal spot and a relatively narrow and inconspicuous band at cord, the small spot before stigma more

or less disconnected from the larger posterior portion that crosses cell *1st* M_2; a broad pale streak bordering both sides of vein *1st A*, with similar pale streaks near the bases of both anal cells; veins dark brown, more brownish yellow in the brightened fields. Venation: *Rs* about twice *m-cu*; R_{1+2} entire; *m* subequal to petiole of cell M_1.

Abdomen yellow; tergites without a median stripe, the lateral vitta broken into small linear sublateral brown streaks on tergites two to six, inclusive, beyond segment two being placed on the basal half or less of each segment; lateral tergal borders broadly pale, the posterior margins narrowly so; sternites yellow, the outer segments somewhat more obscured; hypopygium chestnut yellow. Male hypopygium (Fig. 7) having the ninth tergite, *9t*, with the

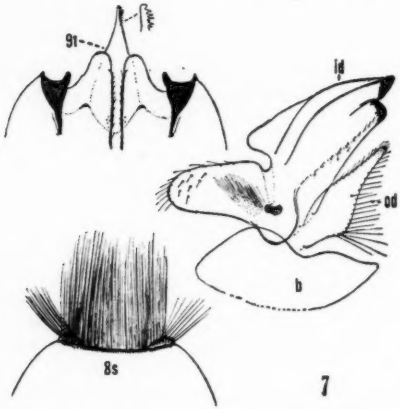

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Fig. 7. *Tipula* (*Lunatipula*) *kaibabensis* sp. nov.; male hypopygium.

(Symbols: *b*, basistyle; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite.)

median blade (subtergal process) compressed, its dorsal edge near apex with conspicuous fingerlike fleshy lobes or fimbriations; canthi relatively long, the tips broadly obtuse to subtruncate, slightly decurved; space between canthi linear, parallel-sided, very narrow, the margins of the dorsal furrow provided with several coarse setae; lateral tergal processes relatively large, sclerotized, each terminating in a subacute blade. Ninth sternite with the appendage strongly bilobed by a subapical constriction, the small apical lobe with the setae short but much stouter than those of the elongate upper lobe. Basistyle, *b*, with the outer margin unproduced, sinuous or gently emarginate opposite the base of the outer dististyle. Outer dististyle, *od*, with its outer third narrowed, the apex obtuse; lower margin of style with very long setae. Inner dististyle, *id*, with the beak stout, blackened, the apex obliquely truncate; lower beak even deeper, its apex truncate; dorsal crest in front very low but becoming extensively produced behind, the posterior end very pale to almost hyaline, obtuse at apex, the margins microscopically serrulate; outer basal lobe brown, not heavily darkened, of moderate size, about three-fifths as long as the main body of style or a little longer than the outer dististyle; lobe generally parallel-sided, its apex obtuse, near base with the usual dense grouping of long silken setae. Eighth

sternite, *8s*, relatively short, sheathing, the apex very broad and gently emarginate, the entire border fringed with very long yellow setae, not interrupted at midline; at each outer lateral angle with a low cushion that is margined with several similar elongate bristles; from the membrane above outer end of sternite with a slender median pale fleshy lobe that is a little shorter than the fringing setae. It should be noted that this lobe is about as described for *mitrata*, fleshy and tending to shrivel in microscope slide mounts so as to be lost or inconspicuous; it does not have the substance or body of the somewhat comparable appendage in species such as *pellucida* Doane, 1912, or *pyramis* Doane, 1912.

Holotype, ♂, Kaibab Plateau, north rim of the Grand Canyon, Arizona, altitude 8,000 ft., June 18, 1942 (*C. P. Alexander*). *Paratopotypes*, 3 ♂♂, June 17-18, 1942 (*C. P. & M. M. Alexander*).

The most similar species is *Tipula* (*Lunatipula*) *mitrata* Dietz, 1921, which shows an evident affinity in the presence of a slender fleshy lobe above the eighth sternite in the male. The present fly differs evidently in the coloration of the body and wings, and in the structure of the male hypopygium, especially of the tergite, including the median blade, canthi and lateral processes, and in the inner dististyle and eighth sternite.

Tipula (*Lunatipula*) *mitrata* Dietz, 1921.—Silver City, Grant County, New Mexico, May 26, 1913; type.

Tipula (Lunatipula) inadusta sp. nov.—Belongs to the *unicincta* group; general coloration of thorax and abdomen brownish yellow, the praescutum with four very narrow reddish brown stripes; wings with a strong brownish tinge, the prearcular and costal fields, with vein Cu_1, clear light yellow; a restricted darker pattern, including the small stigma and vague but broad seams over *m-cu* and distal portions of *Cu;* obliterative band at cord very conspicuous; male hypopygium with the lobes of the tergite relatively broad, the outer apical angle a small spinous point; inner dististyle with the crest produced backward into a pale blade, the posterior end pointed, the outer margin microscopically fimbriate; smaller gonapophyses distinct or separated at bases by membrane; eighth sternite with the lateral lobes terminating in a single large fasciculate bristle; median setae abundant, the outer series not expanded at their tips; median lobe narrow and transverse.

♂. Length, about 17-18 mm.; wing, 19-20 mm.; antenna, about 5-5.1 mm.

♀. Length, about 21-22m m.; wing, 19-20 mm.

Frontal prolongation of head yellow; nasus short and stout; palpi pale brown, the outer two segments somewhat paler. Antennae with scape and pedicel yellow; flagellum very weakly bicolored, the segments light brown, with slightly darkened basal enlargements; outer segments more uniformly darkened. Head yellowish brown, with a slight brown suffusion; vague indications of a capillary brown median vitta on posterior vertex.

Pronotum brown, paler on sides. Mesonotum chiefly brownish yellow, more pruinose laterally, the praescutum with four very narrow and ill-defined reddish brown stripes that are only poorly indicated, the median region of the praescutum in cases gray, in others yellow; posterior sclerites of notum brownish yellow or yellow. Pleura brownish yellow, sparsely pruinose, the anepisternum

a little darker; dorsopleural membrane pale yellow. Halteres with stem yellow, knob darkened, its apex restrictedly yellow. Legs with the coxae yellow, whitish pruinose; trochanters yellow; femora yellow, the tips narrowly but conspicuously blackened; tibiae and basitarsi yellow, the tips even less distinctly darkened; remainder of tarsi dark brown; claws (male) toothed. Wings with a strong brownish tinge, the prearcular and costal fields, together with vein *Cu*, clear light yellow; a restricted darker pattern, including the small stigma and vague but very broad seams over *m-cu* and distal portions of vein *Cu;* a restricted darkening in the vicinity of the arculus; obliterative band before stigma and cord very conspicuous, extending from *C* into the base of cells M_3, including also the outer angle of cell *M;* no post-stigmal brightening; veins brown, yellow in the brightened fields. Venation: *Rs* a trifle less than twice *m-cu*.

Abdomen brownish yellow, the tergites with vague indications of a darker median stripe that is narrowly interrupted by the pale posterior borders of the segments; sternites more uniformly yellow; hypopygium chestnut brown. Male hypopygium (Fig. 8) having the ninth tergite, *9t*, with the lobes relatively

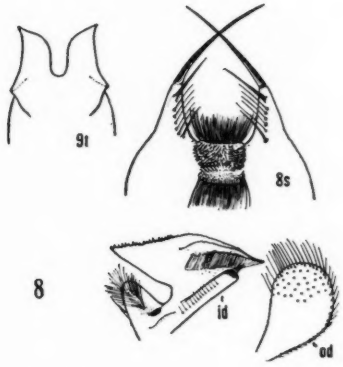

Fig. 8. *Tipula* (*Lunatipula*) *inadusta* sp. nov.; male hypopygium.

(Symbols: *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; t, tergite.)

broad, only slightly narrowed for most of their length, the mesal-apical angle broadly rounded, the outer apical angle a small acute point. Ninth sternite with the appendage large, tumid and obtuse, not at all produced as in *unicincta*. Outer dististyle, *od*, expanded at apex into a large suboval flattened head, provided with long conspicuous setae. Inner dististyle, *id*, with the beak slender, the dorsal and posterior crests strongly produced backward as a pale flattened blade, the posterior end pointed; dorsal margin back from this point with conspicuous fimbriations; outer basal lobe only moderately developed, the tip obtuse, the face with a double crest of long reddish setae. Gonapophyses conspicuous, the short pair slender, separate from one another or interconnected only weakly, not fused into a single median structure as in *bigeminata*, *diacanthophora* or *spatha*. Eighth sternite, *8s*, moderately sheathing, the lateral lobes terminating in a single large fasciculate reddish bristle; along the inner face of lobe with a series of more ordinary setae, the outermost enlarged but still only

about one-third as large as the terminal bristle; median setae unusually abundant, the posterior group long and delicate, not at all expanded or flattened at their ends; intermediate group of setae forming a matlike pattern of appressed curved bristles; the flaplike lobe is narrowly transverse, the caudal margin and surface fringed with long yellow setae that are longer than the lobe itself.

Holotype, ♂, Oak Creek Canyon, Arizona, 5,180 ft., June 10, 1942 (*C. P. Alexander*). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, 7 ♂♂; 1 ♀, June 25, 1942 (*J. & G. Sperry*).

Tipula (*Lunatipula*) *inadusta* is readily told from its closest allies, as *T.* (*L.*) *unicincta* Doane, 1901, by the coloration of the body and, especially, by all details of structure of the male hypopygium, especially the dististyles, gonapophyses, appendage of ninth sternite, and the eighth sternite.

Tipula (Lunatipula) ruidoso sp. nov.—Characters as in *inadusta* sp. nov.; general coloration more grayish pruinose; male hypopygium with all details distinct, these including the tergite, inner dististyle, gonapophyses, and eighth sternite.

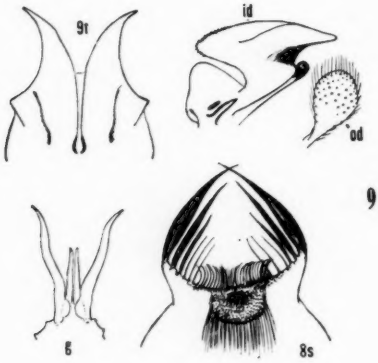

Fig. 9. *Tipula* (*Lunatipula*) *ruidoso* sp. nov.; male hypopygium.

(Symbols: *g*, gonapophysis; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite.)

♂. Length, about 16 mm.; wing, 20.5 mm.; antenna, about 4 mm.

Nasus short and stout; palpi infuscated, the incisures restrictedly pale; terminal segment uniformly darkened. Mesonotum with the ground color gray pruinose; praescutum with four light brown stripes, the intermediate pair widely divergent in front, converging behind, on the posterior half of the sclerite the ground color between these stripes obscure yellow, replacing the gray. Wing pattern very similar; stigma larger and more evident; obliterative band at cord not or scarcely invading cell *M*.

Male hypopygium (Fig. 9) having the ninth tergite, *9t*, with the lobes unusually narrow, terminating in acute subspinous points. Outer dististyle, *od*, with the expanded apex subcircular in outline. Inner dististyle, *id*, differing in all details: beak stouter; the lower margin with the sclerotized rod narrow, expanded at apex into an oval blackened head or lower beak; apex of posterior crest more obtuse; outer basal lobe much broader, as wide across its base as the

total length. Gonapophysis, *g*, apparently represented only by a single pair of developed rods that represent the usual larger pair of apophyses, these larger and more powerfully constructed than in *inadusta*. Eighth sternite, *8s*, with the lateral lobes shorter and stouter, the apical bristle unusually flattened and expanded, its fasciculate nature well-shown; subterminal seta similarly fasciculate but much smaller; third seta again smaller but still showing a fasciculate nature; remaining setae stout but normal; median lobe much broader, its caudal margin gently convex.

Holotype, ♂, Ruidoso, White Mountains, New Mexico, altitude 7,500 ft., May 31, 1942 (*M. M. Alexander*); resting on the trunk of a Douglas Fir.

Tipula (*Lunatipula*) *spatha* Doane, 1912.—Doane's unique type was from "Arizona," without further data. One male, near Tucson, Arizona, 2,400 ft., June 9, 1942 (*M. M. Alexander*).

Tipula (Lunatipula) sanctae-ritae sp. nov.—Allied to *williamsi;* size small (wing, male, 12 mm.); nasus lacking; head gray, with a darker median vitta on posterior vertex; mesonotum with four entire brown praescutal stripes, the lateral pair with gray centers; femora yellow, the tips narrowly dark brown; wings with a rather strong brownish tinge, very restrictedly patterned with darker brown and with a conspicuous obliterative band before cord; no poststigmal brightening; abdominal tergites obscure yellow, with three brown stripes, the median one especially conspicuous; male hypopygium with the median region of the tergite produced into a broad lobe that is deeply split, the lobes microscopically denticulate; inner dististyle with its outer basal lobe moderately stout, tipped with dense yellow setae; eighth sternite with various groups of setae, including modified ones on the lateral lobes and on a median triangular appendage.

♂. Length, about 12 mm.; wing, 12 mm.

Body desiccated and colors in life probably not exactly as described. Frontal prolongation of head brownish gray above, obscure yellow on sides and beneath; nasus lacking; basal segments of palpi yellow, outer ones broken. Antennae broken. Head gray, darker behind; a darker brownish gray median vitta on posterior vertex; setae and setigerous punctures black.

Pronotum obscure brownish yellow, more or less yellow pollinose. Mesonotal praescutum with the ground color obscure yellow, with four entire brown stripes, the anterior ends of the intermediate pair becoming pale and obsolete; capillary median ground vitta very narrow; lateral stripes broader, each with a gray center; humeral region of praescutum weakly darkened; posterior sclerites of notum gray pruinose, each scutal lobe with two brown areas; a scarcely indicated darker central line on mediotergite. Pleura and pleurotergite pale, with a light gray bloom, apparently the anepisternum and ventral sternopleurite darkened beneath the bloom. Halteres broken. Legs with the coxae pale, whitish pruinose; trochanters yellow; femora yellow, the tips narrowly dark brown; tibiae and basitarsi yellow, the outer tarsal segments darkened. Wings with a rather strong brownish tinge, very restrictedly patterned with darker brown and with a relatively conspicuous obliterative area before cord; besides the stigma, the dark areas include very narrow seams at origin of *Rs*, end of *Sc*,

m-cu and the distal section of Cu_1; obliterative band before cord extending from before the stigma across the basal half of cell *1st* M_2 into the proximal third of cell M_3; no post-stigmal brightening; veins pale brown, somewhat more yellowish brown in the prearcular and costal fields. Macrotrichia of veins relatively sparse, especially in outer medial field; several trichia at outer end of Cu_1 and *2nd A*. Venation: *Rs* about twice *m-cu;* R_{1+2} entire; R_3 strongly sinuous; petiole of cell M_1 and *m* subequal, M_{3+4} longer than *m*.

Abdominal tergites obscure yellow, with three brown stripes that are interrupted by pale posterior borders, the median stripe especially conspicuous; lateral tergal borders broadly yellow; sternites and hypopygium yellow. Male hypopygium (Fig. 10) having the ninth tergite, *9t*, with the caudal border

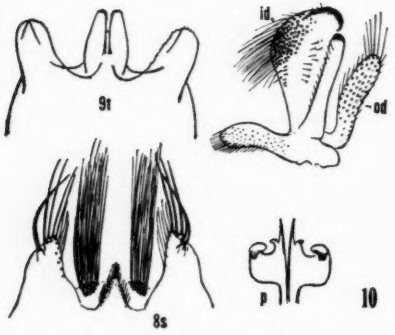

Fig. 10. *Tipula* (*Lunatipula*) *sanctae-ritae* sp. nov.; male hypopygium.

(Symbols: *id*, inner dististyle; *od*, outer dististyle; *p*, phallosome; *s*, sternite; *t*, tergite.)

emarginate, its median region produced into a broad lobe that is further divided for a little less than one-half its length by a narrow split; the lobes thus formed are pale, with conspicuous irregular teeth; lateral tergal lobes broad, their mesal margins microscopically roughened or denticulate. Outer dististyle, *od*, moderately flattened, gently sinuous, provided with abundant black setae, those at apex longest. Inner dististyle, *id*, with the beak blackened, obtuse; lower beak a flattened rod along the ventral margin of style, its tip obtuse; dorsal crest on its outer portion with unusually long and abundant yellow setae that are directed backwards; outer basal lobe flattened, the length about three times the width; tip obtuse, weakly darkened, with a concentration of delicate yellow setae of moderate length. Eighth sternite, *8s*, with the armature unusually complex; lateral lobes flattened, margined with bristles, of which three or four are larger and more powerful, particularly the most basal one; a median triangular lobe that is bordered by strong setae, those at apex more crowded and delicate; in the membrane between the above setal groups a further area bearing unusually long setae, these being the longest on the entire sclerite.

Holotype, ♂, Madera Canyon, Santa Rita Mountains, Arizona, altitude 5,000 ft., June 8, 1912 (*C. P. Alexander*); found dead in a spider's web on building at Big Rock Camp.

There are several western Nearctic species of the subgenus that have this same general type of hypopygium. Among these, the present fly is closest to

Tipula (*Lunatipula*) *williamsi* Doane, 1909, of California, which is much larger, with the details of coloration and structure of the hypopygium distinct. It should be noted that this latter species has the wings of the female sex subatrophied. In the present fly, the fimbriate central lobes of the ninth tergite are distinctive.

Tipula (*Lunatipula*) *macrolabis macrolaboides* Alexander, 1918.—White Mountains, New Mexico, highest summits, altitude 11,092 ft., (*C. H. T. Townsend*); South Fork of Eagle Creek, altitude 8,000 ft., August 13 (*C. H. T. Townsend*).

Tipula (*Lunatipula*) *pleuracicula* Alexander, 1915 (*arizonica* Alexander, 1916; *monochroma* Dietz, 1919).—Williams, Arizona, May 29-30 (*H. S. Barber*); U.S.N.M. Other Arizona records include Kaibab Plateau, north rim of Grand Canyon, 8,000 ft., June 17-18, 1942; Oak Creek Canyon, 5,200-5,400 ft., on unusually dry slopes of canyon, June 10-12, 1942 (*Alexander & Sperry*); Peeples Valley, Utah, May 11, 1945 (*G. F. Knowlton*), abundant among blue grass and squirreltail grass beneath the shade of two large trees.

LIMONIINAE

LIMONIINI

Limonia (*Limonia*) *argenteceps* (Alexander, 1912).—Huachuca Mountains, Arizona, August 1905 (*Henry Skinner*); type.

Limonia (*Limonia*) *triocellata* (Osten Sacken, 1859).—Taos Creek, northern New Mexico, 7,500 ft., July 27, 1934; Sapello Canyon, New Mexico, 8,000 ft., August 9-26, 1901 (*Skinner*); Skinner, 1902-1903.

Limonia (*Limonia*) *simulans* (Walker, 1848) (*defuncta* Osten Sacken, 1859).—New Mexico: Sapello Canyon, 8,000 ft., August 9-26, 1901 (*Skinner*); Cloudcroft, 8,000 ft., June 1, 1942.

Limonia (*Limonia*) *venusta* (Bergroth, 1888) (*negligens* Alexander, 1927).—Frijoles Canyon, Bandelier National Monument, June 19, 1942 (*Sperry*).

Limonia (*Dicranomyia*) *brevivena* (Osten Sacken, 1869). Sabino Canyon, Santa Catalina Mountains, at Tucson, June 7, 1942 (*Alexander & Bueno*).

Limonia (*Dicranomyia*) *distans* (Osten Sacken, 1859).—Old Fort Davis, Davis Mountains, Texas, August 1928 (*Poling*).

Limonia (*Dicranomyia*) *halterata* (Osten Sacken, 1869).—Sapello Canyon, New Mexico, 8,000 ft., August 9-26, 1901 (*Skinner*).

Limonia (*Dicranomyia*) *fulva fulvoides* Alexander, 1943.—Kaibab Plateau, north rim of the Grand Canyon, 8,000 ft., June 18-19, 1942; very common, especially the females.

Limonia (*Dicranomyia*) *humidicola dampfi* (Alexander, 1925).—Huachuca Mountains, Arizona, along creek in Miller Canyon, 6,400 ft., September 4, 1938 (*E. R. Tinkham*).

Limonia (*Geranomyia*) *canadensis* (Westwood, 1835).—Texas: Davis Mountains, along Limpia Creek, 4,000 ft., May 29, 1942. New Mexico: Mescalero Apache Reservation, Sacramento Mountains, 6,000 ft., June 1, 1942. Arizona: Grand Canyon, bottom, at Phantom Ranch, 2,700 ft., June 14, 1942; Wheatfields, near Globe, 3,000 ft., March 29 (*D. K. Duncan*); Oak Creek Canyon, 5,180 ft., June 10-11, 1942; Chiricahua Mountains, 6,000 ft., June 4, 1942; Santa Rita Mountains, 5,000 ft., June 8, 1942.

Limonia (*Geranomyia*) *diversa* (Osten Sacken, 1859).—Wheatfields, near Globe, 3,000 ft., March 29 (*D. K. Duncan*); Oak Creek Canyon, 5,180 ft., June 10, 1942; Santa Rita Mountains, Madera Canyon, 5,000 ft., June 8, 1942.

Limonia (*Geranomyia*) *ibis* (Alexander, 1916).—One female, Sabino Canyon, Santa Catalina Mountains, Arizona, June 9, 1942. Hitherto known only from the type female from Hot Springs, Arkansas. The present specimen agrees closely with the type, differing in certain details of venation, as the somewhat shorter *Sc* and the distinct retention of the supernumerary crossvein in cell *Sc*.

Limonia (*Geranomyia*) *perfecta* (Alexander, 1928).— One male, Wheatfields, near Globe, Arizona, 3,000 ft., March 29 (*D. K. Duncan*). The type was from Tepic, Nayarit, Mexico, altitude 3,069 meters, collected March 14, 1927 (Dampf M. F. No. 1191).

Limonia (Geranomyia) valverdensis sp. nov.—General coloration of thorax uniform yellow or fulvous yellow, unpatterned; rostrum brown, about one-half the length of wing; femora and tibiae yellow, unpatterned; wings with a faint yellowish tinge, unpatterned except for the scarcely darker stigma; *Sc* long, Sc_1 ending about opposite three-fifths *Rs;* male hypopygium with the caudal margin of the ninth tergite with a V-shaped notch; ventral dististyle fully twice as extensive as the basistyle, with two subequal rostral spines; apex of prolongation stout.

♂. Length, excluding rostrum, about 5.5 mm.; wing, 6 mm.; rostrum about 2.9 mm.

Rostrum relatively long, about one-half the length of wing, brown, somewhat paler at base; palpi dark brown. Antennae with scape yellow; pedicel brown, flagellum brownish black; flagellar segments oval, with short verticils. Head in front obscure yellow; posterior vertex extensively gray, the occiput paling to brownish yellow; anterior vertex narrow, subequal to the diameter of scape, with a small brownish spot on either side at narrowest point.

Pronotum yellow. Mesonotum and pleura almost uniformly yellow or fulvous yellow, unpatterned. Halteres with stem yellow, knob very slightly darkened. Legs with coxae fulvous yellow; trochanters yellow; remainder of legs yellow, the terminal tarsal segments darkened. Wings (Fig. 11) with a faint yellowish tinge, prearcular and costal fields somewhat clearer yellow; stigma scarcely indicated, very pale brown; veins light brown, more brownish yellow in the brightened fields. Venation: *Sc* long, Sc_1 ending about opposite three-fifths *Rs*, Sc_2 a short distance from its tip; *cell 1st* M_2 a little shorter than the distal section of M_{1+2}; *m-cu* close to fork of *M;* vein *2nd A* gently sinuous.

Abdomen, including hypopygium, brownish yellow. Male hypopygium (Fig. 12) having the caudal margin of ninth tergite, *9t*, with a V-shaped notch. Basistyle, *b*, small, its total area less than one-half that of the ventral dististyle; ventromesal lobe obtuse at apex. Dorsal dististyle a relatively slender curved rod, its tip acute. Ventral dististyle, *vd*, with the rostral prolongation short, obtuse at tip; rostral spines two, placed close together on outer margin at base of prolongation, without basal tubercles; spines a trifle shorter than the length of the prolongation beyond the outermost spine. Gonapophyses, *g*, pale, mesal-apical lobe flattened, terminating in a small acute point; lateral edge of lobe microscopically crenate. Aedeagus with apical lobes obtuse at tips; surface of aedeagus with microscopic setulae.

Holotype, ♂, Devil's River, Valverde County, Texas, May 4, 1907 (*F. C. Pratt*). Although the station is just east of the Pecos River, I am including it in this paper.

Limonia (*Geranomyia*) *valverdensis* is most similar to *L.* (*G.*) *vanduzeei* (Alexander, 1916), of the southeastern United States, which, while generally similar in coloration, differs in the shorter rostrum, patterned femora, and in the details of structure of the male hypopygium, particularly the tergite and the ventral dististyle, with its rostral prolongation and spines.

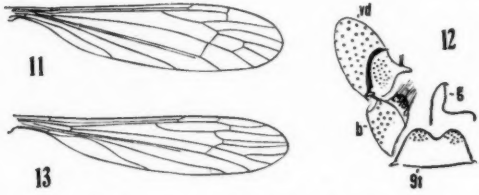

Fig. 11. *Limonia* (*Geranomyia*) *valverdensis* sp. nov.; venation.
Fig. 12. The same; male hypopygium.
Fig. 13. *Orimarga* (*Orimarga*) *sanctae-ritae* sp. nov.; venation.
(Symbols: *b*, basistyle; *g*, gonapophysis; *t*, tergite; *vd*, ventral dististyle.)

Orimarga (*Orimarga*) *arizonensis* Coquillett, 1903.—Hot Springs, Yavapai County, Arizona, June 25-26, 1901 (*H. S. Barber*); type.

Orimarga (Orimarga) sanctae-ritae sp. nov.—General coloration dark gray, the praescutum with four brown stripes; antennae black; halteres brownish black, the base of the stem restrictedly brightened; legs with the coxae black, pruinose; femora, yellow, the tips blackened, wings with a strong blackish tinge, variegated with still darker areas and whitened streaks along certain of the veins; macrotrichia on outer radial veins; Sc_1 ending about opposite midlength of *Rs*; R_{1+2} elongate, nearly three times R_{2+3}; cell M_3 deep, M_{3+4} about three-fourths as long as vein M_3 alone; *m-cu* just before the fork of *M*.

♀. Length, about 6 mm.; wing, 5.8 mm.

Rostrum gray; palpi black. Antennae black throughout; flagellar segments short-oval. Head gray; anterior vertex relatively narrow.

Pronotum gray, infuscated above. Mesonotal praescutum gray, with four brown stripes, the lateral pair crossing the suture onto the scutal lobes; intermediate stripes only narrowly and vaguely separated by a capillary ground line; posterior sclerites of notum chiefly dark plumbeous gray. Pleura dark gray. Halteres brownish black, the base of stem restrictedly brightened. Legs with the coxae black, pruinose; trochanters brownish black; femora yellow, the tips rather narrowly but conspicuously blackened, the amount subequal on all legs and involving about the distal eighth to tenth of the segment; tibiae obscure yellow, the extreme bases and tips darkened; basitarsi dark brown, remainder of tarsi black. Wings (Fig. 13) with a strong blackish tinge, patterned with still darker areas; prearcular field whitened; darker clouds along vein R_1 in the general region of the stigma and in the outer marginal field; a dusky central streak in cell *R;* a conspicuous cloud near base of cell *1st A* at point of narrowing of the anal veins; less distinct dark clouds along vein *Cu* and in the axillary angle; whitish streaks bordering certain of the veins, including outer portions of R_{4+5} and M_{1+2}, much of veins *M*, M_{3+4} and M_4, and near the base of vein *1st A* in cell *1st A;* veins dark brown. Macrotrichia of veins beyond cord relatively numerous on all outer radial veins, becoming sparse in the medial field, lacking on M_{3+4}, *Cu* and the Anals. Venation: *Sc* relatively long, Sc_1 ending about opposite midlength of *Rs*, Sc_2 a short distance from its tip, Sc_1 alone nearly twice R_2; vein R_1 between the free tip of Sc_2 and R_2 about three times the length of the latter; R_{1+2} elongate, nearly three times R_{2+3}; inner end of cell R_4 arcuated, lying proximad of cell R_5; cell M_3 deep, M_{3+4} about three-fourths as long as M_3 alone or a little longer than M_4; *m-cu* unusually far distad for a member of this genus, lying just before the fork of *M;* vein *2nd A* unusually arched beyond the level of arculus, greatly narrowing cell *1st A*, cell *2nd A* opposite this point very wide.

Abdomen, including the genital shield, black; cerci blackened, small and slender, strongly upcurved.

Holotype, ♀, Madera Canyon, Santa Rita Mountains, Arizona, altitude 5,000 ft., June 7, 1942 (*C. P. Alexander*). The type was swept from a damp area overgrown with a species of mint not far from the stream. Close by, only a few feet distant on a wet bank, were nests containing young birds of the Arizona Junco, *Junco phaeonotus palliatus*, and the Painted Redstart, *Setophaga picta picta*.

Orimarga (*Orimarga*) *sanctae-ritae* is very different from all described regional species, its nearest relative being a still undescribed form from Zion National Park, southern Utah. The present fly is well-distinguished by the venation, especially the unusual position of *m-cu*, relative proportions of veins R_{1+2} and R_{2+3}, and the deep cell M_3.

Dicranoptycha quadrivittata Alexander, 1919.—Huachuca Mountains, Arizona, along creek in Miller Canyon, altitude 6,400 ft., September 4, 1938 (*E. R. Tinkham*); Oak Creek Canyon, Arizona, 5,500 ft., June 12, 1942 (*Alexander & Sperry*).

Antocha (*Antocha*) *monticola* Alexander, 1917.—New Mexico: near Cumbres Pass, at Colorado border, altitude 9,500 ft., July 28, 1934. Arizona:

Oak Creek Canyon, 5,500 ft., May 11, 1945 (*G. F. Knowlton*), June 10-12, 1942 (*Alexander & Sperry*).

PEDICIINI

Pedicia (*Tricyphona*) *aspidoptera* (Coquillett, 1905).—Las Vegas Mountains; near Beulah, New Mexico, June (*Cockerell and Viereck*).

Dicranota (*Rhaphidolabis*) *neomexicana* (Alexander, 1912).—Beulah, New Mexico, June 29, 1902 (*Viereck*); type. White Mountains, New Mexico, altitude 7,500 ft., May 31, 1942, along small mountain stream beneath Douglas Fir; Mescalero Apache Indian Reservation, Sacramento Mountains, 5,000 ft., June 1, 1942. Oak Creek Canyon, Arizona, 5,500 ft., June 12, 1942.

HEXATOMINI

Epiphragma (Epiphragma) arizonensis sp. nov.—Mesonotal praescutum with four dark gray stripes, the posterior interspaces grayish brown, with conspicuous dark punctures; scutellum obscure yellow; pleura yellowish gray, variegated with dark brown; femora yellow, with a vague, narrow brown ring before tip; wings whitish subhyaline, heavily patterned with pale brown areas that are very narrowly but distinctly bordered by dark brown, the costal and subcostal areas without ground centers; cell *1st* M_2 large and much widened outwardly; abdominal tergites grayish yellow, with vague indications of three slightly darker stripes; transverse impressions on tergites dark brown; setigerous punctures abundant and conspicuous; interbases of male hypopygium with subtriangular reflexed tips.

♂. Length, about 11-12 mm.; wing, 13 mm.; antenna, about 3.1 mm.

♀. Length, about 16 mm.; wing, 13 mm.

Rostrum dark brown, gray pruinose; palpi black. Antennae with scape black; pedicel brown, paler beneath; basal two or three flagellar segments yellow, the outer ones passing into brownish black; fusion-segment comprised of two elements, the suture very faintly indicated; outer segments long-cylindrical, with elongate verticils, the longest exceeding the segments in length; terminal segment a trifle longer than the penultimate. Head dark gray, the region of the low vertical tubercle more darkened; region of posterior orbits paler; a more or less distinct capillary black median vitta on posterior vertex; setigerous punctures distinct.

Pronotum with scutum brownish gray, with coarse dark punctures; scutellum chiefly yellow. Mesonotal praescutum with the disk almost covered by four dark gray stripes, the intermediate pair separated by a slightly paler gray line; posterior interspaces more grayish brown, with conspicuous dark punctures; humeral and lateral portions of praescutum broadly obscure orange, the extreme border dark brown; in cases, including the holotype, the lateral border is chiefly dark brown; scutum chiefly brownish gray, each lobe with two darker brown areas; posterior borders of scutal lobes and the scutellum obscure yellow; mediotergite broadly yellow medially, more darkened on sides, especially on cephalic half, the entire surface more or less pruinose; pleurotergite chiefly pale, sparsely pruinose. Pleura with the ground yellow, gray pruinose, varie-

gated with dark brown, including part of the dorsopleural membrane and major areas on the anepisternum, ventral sternopleurite and ventral meron. Halteres with stem obscure yellow, knob darkened, its tip vaguely paler. Legs with the coxae brownish yellow; trochanters paler yellow; femora yellow, with a narrow and vague brown ring just before the tip; remainder of legs yellow, the outer segments a little more darkened; claws with long basal spine. Wings (Fig. 14) whitish subhyaline, heavily patterned with pale brown areas that are distinctly but very narrowly bordered by dark brown; costal areas without ground centers in either cells *C* or *Sc;* marginal spots on outer radial veins large and full; base of cell *1st A* entirely clear; outer dark band at end of cell *1st* M_2 broader than in *solatrix* and tending to become much broken; in cases, including type, a dark spot at midlength of cell *2nd A;* veins brown, somewhat darker in the patterned fields. Venation: Supernumerary crossvein in cell *Sc* oblique; *Rs* angulated and long-spurred near origin, in the type the spur completely traversing cell *R;* R_{2+3+4} long and nearly straight, exceeding *m-cu;* cell *1st* M_2 large and much widened outwardly.

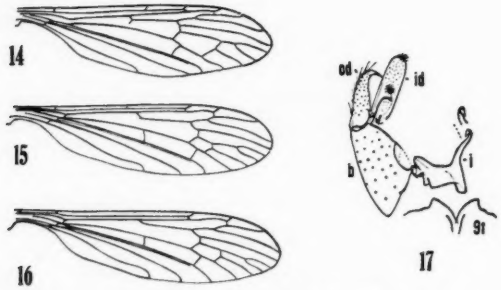

Fig. 14. *Epiphragma* (*Epiphrama*) *arizonensis* sp. nov.; venation.
Fig. 15. *Limnophila* (*Elaeophila*) *edentata* Alexander; venation.
Fig. 16. *Limnophila* (*Elaeophila*) *woodgatei* sp. nov.; venation.
Fig. 17. *Epiphragma* (*Epiphragma*) *arizonensis* sp. nov.; male hypopygium.
(Symbols: *b*, basistyle; *i*, interbase; *id*, inner dististyle; *od*, outer dististyle; *t*, tergite.)

Abdominal tergites chiefly grayish yellow, with vague indications of three slightly darker broken stripes; transverse impressions darker brown and more distinct; brown setigerous punctures abundant and conspicuous; sternites, especially of female, more yellowed. Male hypopygium (Fig. 17) with the submedian tergal lobes, *9t*, low, separated by a deep V-shaped notch. Outer dististyle, *od*, with conspicuously pale setae to the base of the curved apical spine. Inner dististyle, *id*, flattened, its apex obtuse, provided with a few pale setae; near basal third with a group of about a dozen blackened setae on a small flange. Interbases, *i*, with the short, subtriangular apices reflexed.

Holotype, ♂, Oak Creek Canyon, Arizona, altitude 5,180 ft., June 12, 1942 (*C. P. Alexander*). *Allotopotype*, ♀. *Paratopotype*, 1 ♂.

The nearest relative of the present fly is *Epiphragma* (*Epiphragma*) *solatrix* (Osten Sacken, 1859), which differs in all details of coloration of the body and wings, and in the structure of the male hypopygium, particularly the tergal lobes and the interbases.

Limnophila (*Elaeophila*) *edentata* Alexander, 1919.—Oak Creek Canyon, Arizona, altitude 5,180 ft., June 10-12, 1942.

Limnophila (Elaeophila) woodgatei sp. nov.—Size relatively large (wing, female, 8.5 mm.); general coloration gray, the notum conspicuously patterned with dark brown; femora yellow, the tips conspicuously blackened; wings with the ground color grayish white, with an unusually heavy spotted and dotted brown pattern, the dark color subequal in extent to the pale; dark crossband at origin of *Rs* virtually unbroken and of nearly equal width throughout; dashes in costal interspaces conspicuous; margin of wing, including axillary border, very extensively washed with brown; R_{2+3+4} relatively long, approximately one-third *Rs;* cell *1st* M_2 large, subequal in length to vein M_4 beyond it.

♀. Length, about 9 mm.; wing, 8.5 mm.

Rostrum black, sparsely pruinose; palpi black. Antennae with scape black, pruinose; pedicel reddish brown; basal flagellar segments yellow, the outer ones broken. Head gray, the central portion of vertex extensively infuscated.

Pronotum large, gray, the central and lateral portions extensively infuscated; scutellar lobes more yellowed; pretergites pale yellow. Mesonotal praescutum gray, with a conspicuous brown pattern, including two intermediate stripes that converge or touch in front and less evidently so behind; median ground line subequal in width to either stripe, lateral stripes narrow; additional brown spots on praescutum include the lateral borders behind the pseudosutural foveae and a series of small brown dots in the posterior interspaces, the largest at the suture; pseudosutural foveae black; posterior sclerites of notum gray, patterned with dark brown, including a common central line on scutum and scutellum, on the latter not reaching the posterior border; mediotergite with a capillary brown central vitta. Pleura and pleurotergite gray, conspicuously patterned with dark brown, most extensively so on the ventral sternopleurite and meron but including areas on all other pleurites; dorsopleural membrane chiefly infuscated. Halteres with stem yellow, knob infuscated. Legs with coxae dark brown, gray pruinose; trochanters obscure yellow; femora obscure yellow, the tips conspicuously blackened, preceded by a slightly clearer yellow ring of about equal extent; remainder of legs light yellow, the tips of tibiae and the outer tarsal segments more infuscated. Wings (Fig. 16) with the ground color grayish white, with an unusually heavy spotted and dotted brown pattern, the dark color subequal in extent to the pale; major dark costal area at near mid-distance between *h* and the origin of *Rs;* a complete crossband at origin of *Rs* and over the supernumerary crossvein in cell *M*, reaching the posterior margin near the outer end of cell *2nd A;* third dark area over fork of *Sc*, the fourth at stigma, the latter two converging behind over the anterior cord; outer costal areas at ends of veins R_3 and R_4; cord and outer end of cell *1st* M_2 seamed with brown; very

extensive and more or less confluent paler brown clouds at ends of all longitudinal veins, almost unbroken in the axillary area; all interspaces with abundant brown dashes and spots on the veins, including a very conspicuous series in cells *C* and *Sc;* elsewhere on wing, particularly before cord in cells *Cu, 1st A* and *2nd A,* the membrane is extensively washed with pale brown; vein *1st A* unpatterned, *2nd A* with a series of about five darker brown spots before the major dark subterminal area; veins yellow, darker in the interspaces, very conspicuous in the outer costal spaces. Venation: R_{2+3+4} longer than in *edentata* (Fig. 15), approximately one-third *Rs;* cell *1st* M_2 larger than in *edentata,* rectangular, subequal in length to vein M_4 beyond it.

Abdominal segments dimidiate, obscure yellow, the posterior borders of the segments dark brown, more conspicuous on the sternites where the bands are broader, reaching the posterior border and more or less darkening the lateral portions of the segments; on the tergites, the subterminal dark bands are narrower, the extreme tips of the segments narrowly pale, with indications of a second subbasal darkened band; genital shield fulvous; cerci light yellow, hypovalvae darker on proximal two-thirds.

Holotype, ♀, Jemez Springs, New Mexico, altitude 6,400 ft., June 12, 1916 (*John Woodgate*).

Named in honor of the veteran collector of New Mexican insects, John Woodgate. Although only the female sex is known, I believe that the present fly is distinct from the more western *Limnophila* (*Elaeophila*) *edentata* Alexander, 1919, which is the most similar known species. The differences in the female sex are found chiefly in the wing pattern and venation and these have been detailed in the above description. The venation of *edentata* is shown for comparison (Fig. 15).

Limnophila costata Coquillett, 1901.—The type was from the alpine summits between the Pecos and Sapello Rivers, New Mexico, altitude about 11,000 ft., in the Hudsonian zone, August 1-4, 1900 (*T. D. A. Cockerell*); U. S. Nat. Mus. No. 5318. I have not been able to recognize this species in later collections.

Hexatoma (*Eriocera*) *austera* (Doane, 1900).—Jemez Springs, New Mexico, altitude 6,400 ft., May 17, 1916 (*John Woodgate*). I possess a rather large series showing a most surprising variation in the wing venation that serves to connect the two supposed subgenera *Hexatoma* Latreille, 1809, and *Eriocera* Macquart, 1838 (a part of the series mounted on microscope slides in the Alexander Collection).

Hexatoma (*Eriocera*) *eriophora* (Williston, 1894).—Frijoles Canyon, New Mexico, June 22, 1942 (*J. & G. Sperry*). The reference to *H.* (*E.*) *spinosa* (Osten Sacken, 1859) from near Beulah, New Mexico, in Sapello Canyon, San Miguel Co., New Mexico, 8,000 ft., August 9-26, 1901 (Skinner, 1903: 101-106) evidently refers to the present species.

Hexatoma (*Eriocera*) *velveta* (Doane, 1900).—New Mexico: Mescalero Apache Indian Reservation, Sacramento Mountains, 7,000 ft., June 1, 1942; Cloudcroft, Sacramento Mountains, 8,000 ft., June 2, 1942. Arizona: Oak Creek Canyon, 5,500 ft., June 12, 1942.

ERIOPTERINI

Teucholabis (Teucholabis) duncani sp. nov.—General coloration black, the thorax variegated with yellow on the scutellum and pleura; head dark gray; wings hyaline, with a conspicuous short-oval dark brown stigma; *Sc* relatively long, both Sc_1 and Sc_2 lying beyond the origin of *Rs;* tip of R_{1+2} pale to subatrophied.

♀. Length, about 5 mm.; wing, 5.5-5.6 mm.

Rostrum and palpi black. Antennae with the basal segments black; outer segments broken. Head dull dark gray; anterior vertex broad, about four times the diameter of the scape.

Pronotum black, the pretergites light yellow. Mesonotal praescutum black, the surface subnitidous to nitidous; humeral region restrictedly reddened; scutal lobes black, the cephalic end of the central portion, with the adjoining part of the praescutum, restrictedly reddened; posterior median portion of scutum heavily gray pruinose; scutellum broad, yellow, parascutella brownish black; postnotum black, the mediotergite heavily pruinose except at posterior border; suture between mediotergite and pleurotergite restrictedly reddened. Pleura black, with a conspicuous silvery white longitudinal stripe, extending from behind the fore coxae to the base of abdomen, slightly widened behind; dorsopleural membrane yellow. Halteres black throughout. Legs with the fore coxae black, mid-coxae brown, hind coxae black to brown; trochanters obscure brownish yellow; femora yellow, the tips dark brown, the amount subequal on all legs, including the distal sixth (fore legs) to eighth (hind leg); tibiae and basitarsi obscure yellowish brown, the tips dark brown; outer tarsal segments more uniformly blackened. Wings (Fig. 18) hyaline, the prearcular field more yellowed; a conspicuous short-oval dark brown stigma; veins dark brown in the brightened prearcular portion. Venation: *Sc* relatively long, Sc_1 ending at near one-half to three-fifths the length of *Rs*, Sc_2 distinctly beyond the origin of *Rs;* R_2 more or less oblique; R_{2+3+4} very short; tip of R_{1+2} pale to subatrophied; branches of *Rs* strongly divergent at outer ends, especially R_5 which terminates just before the wing-tip; cell *1st* M_2 a little longer than vein M_4 beyond it; *m-cu* about one-third to one-half its length beyond the fork of *M;* vein *2nd A* nearly straight for most of its length.

Abdomen black, the extreme posterior borders of the outer sternites very restrictedly pale. Ovipositor with the genital shield black, the cerci horn-yellow, slender, gently upcurved to the acute tips.

Holotype, ♀, Wheatfields, near Globe, Gila County, Arizona; down Pinal Creek, along a running stream, altitude 3,000 ft.; a broad canyon lying between the north point of the Superstition Range and part of the Sierra Ancha Range, which lies between Pinal Creek and Salt River, March 29 (*D. K. Duncan*). *Paratopotype,* ♀.

The species is named for the collector, Mr. Douglas K. Duncan, who added many species of insects to the Arizona list. The fly is closest to *Teucholabis* (*Teucholabis*) *lucida* Alexander, 1916, of eastern North America (as far west as the Ozarks, Missouri), differing in the larger size and in details of colora-

tion and venation, as the longer vein *Sc*. The still undiscovered male will undoubtedly provide additional specific characters.

Teucholabis (*Teucholabis*) *rubescens* Alexander, 1914.—New Mexico: Rio Ruidoso, White Mountains, 6,500 ft., July 25; hovering around the trunks of Mountain Cottonwood (*C. H. T. Townsend*); type. Arizona: Oak Creek Canyon, 5,180 ft., June 10, 1942.

Gonomyia (Progonomyia) plumbea sp. nov.—General coloration of thorax dark plumbeous gray, the praescutum with four brown stripes; pseudosutural foveae shiny black, very conspicuous; thoracic pleura without a yellow stripe, variegated only by a small obscure yellow area below the root of the halteres; knobs of halteres darkened; fore legs chiefly black, the remaining legs paler, the tips of the femora and tibiae narrowly darkened; wings subhyaline, stigma medium brown; *Sc* short, Sc_1 ending about opposite two-fifths the length of *Rs;* abdomen brownish black.

♀. Length, about 6.5 mm.; wing, 6 mm.

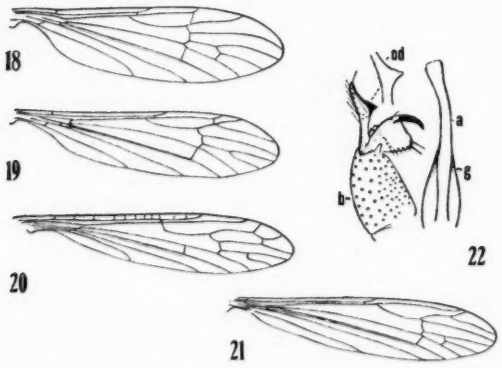

Fig. 18. *Teucholabis* (*Teucholabis*) *duncani* sp. nov.; venation.
Fig. 19. *Gonomyia* (*Progonomyia*) *plumbea* sp. nov.; venation.
Fig. 20. *Gonomyia* (*Euptilostena*) *polingi* sp. nov.; venation.
Fig. 21. *Gonomyia* (*Gonomyia*) *triformis* sp. nov.; venation.
Fig. 22. The same; male hypopygium.
(Symbols: *a*, aedeagus; *b*, basistyle; *g*, gonapophysis; *od*, outer dististyle.)

Rostrum grayish pruinose; palpi black. Antennae black throughout; flagellar segments subcylindrical, the outer ones more elongate-oval. Head gray.

Pronotum dark plumbeous gray; anterior pretergites and the restricted humeral region of praescutum obscure yellow. Mesonotum gray, the praescutum with four brown stripes, the intermediate pair separated by a more brownish gray vitta of nearly equal width; pseudosutural foveae shiny black, very conspicuous; tuberculate pits small and inconspicuous, near the extreme cephalic border of praescutum; posterior sclerites of notum dark plumbeous gray. Pleura

almost uniformly dark plumbeous gray, variegated by a vague obscure area below the halteres, involving the ventral pteropleurite and adjoining sclerites. Halteres with stem obscure yellow, knob darkened. Legs with the coxae plumbeous gray, the apices restrictedly more reddened; trochanters chestnut brown; fore legs chiefly brownish black, the femoral bases restrictedly more brightened; remaining legs paler brown, the tips of the femora and tibiae, and the outer tarsal segments more darkened. Wings (Fig. 19) subhyaline or with a very faint brownish tinge; stigma oval, medium brown; veins brown. Venation: *Sc* short, Sc_1 ending about opposite two-fifths the length of *Rs*, Sc_2 about opposite the basal sixth of this latter vein; R_{3+4} short; *m-cu* at fork of *M*.

Abdomen brownish black, the pleural membrane more yellowed; genital shield more reddish brown. Ovipositor with valves, especially the cerci, horn-yellow.

Holotype, ♀, Santa Rita Mountains, Arizona, June 21, 1935 (*F. H. Parker*); Alexander Collection, through the kindness of Dr. A. L. Melander.

Gonomyia (*Progonomyia*) *plumbea* is readily distinguished from the described regional species of the subgenus by the almost uniform dark plumbeous gray coloration, polished black pseudosutural foveae, and in the details of venation, as the short *Sc* that ends before midlength of *Rs*.

Gonomyia (Euptilostena) polingi sp. nov.—General coloration dark, gray pruinose, variegated with yellow, including stripes on the thoracic pleura; basal flagellar segments black, with the tips narrowly pale; femora yellow, the tips narrowly brownish black; wings whitish hyaline, patterned with dark brown, including a series of about a dozen spots in cell *C*; a series of about ten supernumerary crossveins in cell *C*; *m-cu* more than three times its own length before the fork of *M*.

♀. Length, about 7 mm.; wing, 7-7.1 mm.

Rostrum and palpi black. Antennae with the scape black, narrowly reddened above; pedicel obscure brownish; basal flagellar segments black, the tips narrowly pale; outer flagellar segments uniformly black; flagellar segments elongate-oval to subcylindrical; longest verticils of the intermediate segments a trifle shorter than the segments. Head discolored, the front and anterior orbits narrowly reddened; posterior portion of head dark gray.

Pronotum long, black above, probably pruinose in fresh specimens, the sides yellow; pretergites light yellow. Mesonotal praescutum chiefly covered by three confluent black stripes, probably gray pruinose in fresh specimens; humeral region narrowly reddened; pseudosutural foveae black; posterior sclerites of notum black and presumably pruinose; scutellum extensively more reddened. Pleura black, pruinose, striped longitudinally with yellow, narrowly so on the propleura and dorsal sternopleurite, widened behind. Halteres with stem white, knob blackened. Legs with the coxae blackened basally, yellow at tips, the middle pair extensively so; trochanters obscure yellow; femora and tibiae yellow, the tips narrowly brownish black, conspicuous; tarsi passing through brown to brownish black. Wings (Fig. 20) whitish hyaline, with a conspicuous dark brown pattern arranged as follows: A costal series covering the supernumerary totalling about a dozen between *h* and the tip of Sc_1; one

or two further in cell *Sc* over the origin of *Rs;* larger dark spots include the stigma; origin of *Rs;* along the cord and fork of M_{1+2}; over the supernumerary crossvein in cell R_4; distal ends of outer radial cells; before outer end of vein *2nd A* in cell *1st A;* veins light brown, darker in the patterned areas. Venation: *Sc* long, Sc_1 ending about opposite five-sixth the length of *Rs;* a supernumerary crossvein in cell R_4 at near midlength of vein R_4; *m-cu* more than three times its length before the fork of *M;* a series of about ten supernumerary crossveins in cell *C* between *h* and the tip of Sc_1.

Abdomen brownish black, sparsely pruinose, the caudal borders of the intermediate segments narrowly yellow. Ovipositor with the valves reduced, the cerci small and fleshy, with setae almost to the obliquely truncated tips.

Holotype, ♀, Old Fort Davis, Davis Mountains, Texas, altitude 5,000 ft.; May 28, 1942 (*C. P. Alexander*). *Paratypes,* 1 ♀, Andreas Canyon, near Palm Springs, Riverside County, California, April 22, 1945 (*J. A. Comstock*); taken beneath icebox in house; ♀ ♀, Cuernavaca, Morelos, Mexico, on the shores of a clear mountain brook in dense woods, 1540 meters, April 21, 1930 (A. M. Dampf, No. 1629); ♀ ♀, Chilpancingo, Guerrero, Mexico, at light, in a barranca on shores of a rivulet, some portions of which have muddy bottoms, others with gravel, 1350 meters, December 16, 1929 (A. M. Dampf, No. 1522).

I name this interesting species for Mr. and Mrs. Otto C. Poling, who have contributed so materially to our knowledge of the insect fauna of the Davis Mountains. The only other New World species of *Euptilostena* Alexander is the Mexican *Gonomyia* (*Euptilostena*) *dampfiana* Alexander, which superficially resembles the present fly but is readily told by the lack of the supernumerary crossveins and accompanying dark markings in cell *C* of the wings. The subgenus had not been recorded hitherto from the Nearctic Region. The occurrence of abundant supernumeraries in cell *C* is of unusual interest in this genus. Other species in the subgenera *Idiocera* Dale and in *Euptilostena,* as the Palaearctic *Gonomyia* (*Idiocera*) *sexguttata* (Dale) and *G.* (*E.*) *reticulata* Alexander have dark marks or dashes in this cell but do not have the extra crossveins.

Gonomyia (*Idiocera*) *coloradica* Alexander, 1920.—Arizona: Oak Creek Canyon, 5180 ft., June 10-12, 1942, abundant along the stream; Santa Ritas, near Big Rock Camp, Madera Canyon, 5000 ft., June 8-9, 1942.

Gonomyia (*Lipophleps*) *cinerea* (Doane, 1900).—Old Fort Davis, Davis Mountains, Texas, 5000 ft., November 15, 1925 (*Poling*).

Gonomyia (*Lipophleps*) *helophila* Alexander, 1916.—Old Fort Davis, Davis Mountains, Texas, 5000 ft., November 11-15, 1925 (*Poling*).

Gonomyia (*Gonomyia*) *spinifer* Alexander, 1918.—Texas: Old Fort Davis, 5,000 ft., November 15, 1925 (*Poling*). Arizona: Oak Creek Canyon, 5,180 ft., June 10-12, 1942.

Gonomyia (*Gonomyia*) *filicauda* Alexander, 1916.—Taos Creek, New Mexico, 7,500 ft., July 27, 1934 (*Alexander*).

Gonomyia (Gonomyia) triformis sp. nov.—Allied to *poliocephala;* antennae black; mesonotum dark gray, the posterior border of scutellum vaguely

reddened; legs brownish black; wings relatively narrow, stigmal region faintly darkened; Sc_1 ending before origin of *Rs;* male hypopygium with the outer dististyle expanded on distal half into a flattened dusky triangular blade, the margin near the point slightly erose; aedeagus elongate, the subtending closely applied apophyses broad, their tips not produced into free spines.

♂. Length, about 5-6 mm.; wing, 5-6.5 mm.

Rostrum obscure brownish yellow; palpi black. Antennae relatively elongate, black; flagellar segments elongate, subfusiform, the verticils shorter than the segments. Head obscure yellow, vaguely patterned with darker.

Pronotum pale yellow, narrowly darkened medially. Mesonotum dark gray, the praescutum without clearly differentiated stripes; humeral region yellow; pseudosutural foveae conspicuous, blackened; posterior border of scutellum vaguely reddened. Pleura yellow, indistinctly patterned with darker, forming vague dorsal and ventral stripes. Halteres with stem yellow, knob infuscated. Legs with the coxae and trochanters yellow; remainder of legs brownish black, the femoral bases restrictedly brightened. Wings (Fig. 21) relatively narrow, grayish subhyaline; stigmal region very faintly darkened; veins brown. Costal fringe relatively long and conspicuous. Venation: *Sc* short, Sc_1 ending just before origin of *Rs*, Sc_2 some distance from its tip, Sc_1 alone about two-thirds *m-cu;* R_{2+3+4} only moderately arched, about three-fourths as long as *Rs;* vein R_4 elongate, cell R_3 at margin correspondingly extensive; cell *1st* M_2 longer than vein M_4 beyond it; *m-cu* about one-third its length beyond the fork of *M*.

Abdomen dark brown, with pale incisures; hypopygium yellow. Male hypopygium (Fig. 22) with the outer dististyle, *od*, of moderate length, approximately equal to the inner dististyle; stem narrow, the apical half of mesal face expanded into a triangular dusky blade, the margin weakly erose; outer face of style with relatively long setae, especially the outermost. Inner dististyle with the outer darkened spine or blade extending beyond the tip of the style, on outer margin near base with a single strong seta; fasciculate setae only slightly modified. Aedeagus, *a*, elongate, the apex only feebly expanded, entire; subtending apophyses, *g*, equal to one another in size and shape, not produced into free spines at tip, being closely appressed to the aedeagus.

Holotype, ♂, Chiricahua Mountains, Arizona, 7,500 ft., June 6, 1942 (*C. P. Alexander*); swept from vegetation along small mountain stream. *Paratype*, ♂, Kaibab Plateau, Arizona, 8,000 ft., along small stream at the Kanabownits Spring, June 19, 1942 (*C. P. Alexander*).

The nearest relative of the present fly is *Gonomyia* (*Gonomyia*) *poliocephala* Alexander, 1924 (California to Colorado), which differs in the coloration of the head, broader wings with distinct venational details, and in the structure of the male hypopygium, especially of the dististyles and phallosome.

Gnophomyia (Gnophomyia) apache sp. nov.—Generally similar to *luctuosa*, differing especially in the structure of the male hypopygium, particularly the simple outer dististyle; gonapophysis with the apical point relatively short, directed mesad.

♂. Length, about 6.5 mm.; wing, 7 mm.

♀. Length, about 7 mm.; wing, 7-7.5 mm.

In general appearance, very much like *luctuosa* Osten Sacken, 1859, and confused with this latter species in collections.

Rostrum and palpi black. Antennae short in both sexes, black throughout; basal flagellar segments very short-oval, the outer segments smaller and a little more elongate. Head black; anterior vertex a little exceeding three times the diameter of scape.

Thorax almost uniformly dull black, very restrictedly pruinose. Halteres and legs uniformly black. Wings strongly blackened, the veins still darker. Venation: R_2 at or close to the fork of R_{2+3+4}; *m-cu* about one-third its length beyond the fork of M. The paratype male has only one wing preserved, this with abnormal venation, cell M_2 being open by the atrophy of the basal section of M_3.

Abdomen, including the genitalia of both sexes, black. Male hypopygium of the general type of *luctuosa;* basistyle produced caudad far beyond the origins of the dististyles, approximately to the tip of the outer style; apex of lobe of basistyle pale, flattened, obtuse. Outer dististyle a simple slender yellow blade, the basal half more expanded. Inner dististyle shorter, a flattened dark colored plate, its apex unequally bilobed. Gonapophysis with apical point relatively short, directed mesad. In *luctuosa,* the outer dististyle is bispinous, there being a smaller, more slender lateral spine that is a little less than one-half the apical point, the latter shorter and stouter than in the present fly. Gonapophysis at apex produced into a long needlelike point, these decussate across the median line. Aedeagus stouter, the apex more crook-shaped.

Holotype, ♂, Santa Rita Mountains, Arizona, altitude 7,000 ft. *Allotype,* ♀, Huachuca Mountains, Arizona (U.S.N.M., ex Brooklyn Mus. Coll. 1929, No. 107). *Paratopotype,* 1 broken ♂; *paratypes,* 1 ♂, 1 ♀, with the allotype.

Cryptolabis (*Cryptolabis*) *minutula* Alexander, 1927.—Old Fort Davis, Texas, along Limpia Creek, altitude 5,000 ft., at light, November 15, 1925 (*Poling*); types; 4,000 ft., May 29, 1942 (*Alexander*).

Cryptolabis (Cryptolabis) sica sp. nov.—Size medium (wing, male, about 4 mm.); general coloration of thorax dark brown or brownish black, variegated with yellow, including a central line on scutellum and major areas on postnotum and pleura; femora yellow, the tips brownish black; wings grayish subhyaline, the prearcular and costal fields more yellowed; male hypopygium with the dististyle a flattened blade, terminating in a simple acute beak, before apex of outer margin bearing a narrow acute blade; aedeagus relatively short and stout.

♂. Length, about 3.5-3.6 mm.; wing, 3.8-4 mm.

♀. Length, about 4 mm.; wing, 4.5 mm.

Rostrum brownish gray; palpi dark brown. Antennae short, dark brown; in the type, basal two flagellar segments more or less fused into a single major element, in other specimens with all segments distinct; segments oval, with long outspreading verticils. Head dark brown; vertex elevated, with a yellow spot on either side adjoining eyes; head conspicuously hairy.

Pronotum, pretergites and lateral praescutal border pale yellow. Mesonotum dark brown or brownish black, sparsely pruinose, the pattern of praescutum

forming a discal shield; central portion of scutum and scutellum obscure yellow, the latter especially distinct; postnotum dark, with a common yellow area on anterolateral angle of mediotergite and adjoining portion of pleurotergite. Pleura chiefly dark brown, sparsely pruinose, variegated with pale yellow, including the dorsopleural membrane, an area at and before wing-root, propleura and dorsal sternopleurite, producing a conspicuous checkered appearance. Halteres with stem dusky, base and knob more yellowed. Legs with fore and middle coxae yellow, the posterior pair darker; trochanters yellow; femora obscure yellow basally, passing into brown, the tips narrowly brownish black; tibiae and basitarsi pale brown, the tips darker, the outer tarsal segments blackened. Wings (Fig. 23) grayish subhyaline, the prearcular and costal fields more yellowed; stigma barely indicated; a small axillary darkening; veins brown, yellow in the prearcular field. Cells beyond and slightly before cord (male) with abundant macrotrichia, involving approximately the distal half of wing; in female, restricted about to outer third of wing. Venation: *Rs* oblique, slightly extended, moderately convex, cell R_1 triangular; *m-cu* on M_4 about one-third to one-fourth its length beyond origin, in cases at or close to the fork of M_{3+4}.

Abdomen, including hypopygium, brownish black to black. Male hypopygium (Fig. 24) with the dististyle, *d*, a flattened blade, terminating in a simple acute beak, the outer margin before apex with an erect flattened spinous blade; surface of style with numerous long pale setae. Aedeagus, *a*, relatively short and stout, straight, the apex suddenly narrowed into a slender point.

Holotype, ♂, Oak Creek Canyon, Arizona, altitude 5,180 ft., June 10, 1942 (*C. P. Alexander*). *Allotopotype*, ♀. *Paratopotypes*, numerous ♂ ♀, June 10-12, 1942; *paratypes*, numerous ♂ ♀, Weeping Rock, Zion National Park, 4,420-4,450 ft., June 21-22, 1942 (*M. M. Alexander*).

Cryptolabis (*Cryptolabis*) *sica* is readily told by the structure of the male hypopygium, especially the shape and armature of the dististyle. The most similar species is *Cryptolabis* (*C.*) *pachyphallus* Alexander, 1943, with an extensive range in the Rocky Mountain region.

Rhabdomastix (*Sacandaga*) *californiensis* Alexander, 1921.—One female, Pinal Mountains, Arizona, June 11, 1935 (Parker Lot 179); in Melander Collection. I can see no difference from the type (Monterey County, California) excepting the uniformly darkened scutellum.

Rhabdomastix (*Sacandaga*) *leonardi* Alexander, 1930.—Taos Creek, New Mexico, 7,500 ft., July 27, 1934 (*M. M. Alexander*).

Ormosia (*Ormosia*) *cockerelli* (Coquillett, 1901).—New Mexico: Summit of the range between the Pecos and Sapello Rivers, altitude about 11,000 ft., Hudsonian zone, August 1-4, 1900 (*Cockerell*); type, female. Near the Colorado border at Cumbres Pass, 9,500 ft., July 28, 1934.

Ormosia (*Ormosia*) *onerosa* Alexander, 1943.—Arizona: North rim of the Grand Canyon, Kaibab Plateau, at the Kanabownits Spring, 8,000 ft., June 19, 1942.

Erioptera (*Empedomorpha*) *empedoides* (Alexander, 1916).—A very characteristic species of the arid and semiarid sections of the midwestern and

southwestern United States. The general range of the fly is indicated by the following distribution:

South Dakota: Ardmore, Fall River County, August 10, 1915 (*E. G. Holt*); U. S. Biological Survey, part of the type material.

Kansas: Cimarron, Gray County, July 13, 1917 (*C. P. Alexander*); Wallace County, altitude 3,440 ft., (*F. X. Williams*); Kansas University.

Texas: Brownwood, Brown County, June 17, 1919 (*W. A. Hoffman*); Brownsville, Cameron County, May 3, 1904 (*H. S. Barber*); U. S. N. M.; Big Bend Park, Brewster County, July 29, 1937 (*Rollin H. Baker*).

New Mexico: Jemez Springs, Sandoval County, 6,400 ft., August 8, 1915 (*John Woodgate*); type, Alexander Collection; Lordsburg, Grant County, July 13, 1917, at light (*J. Bequaert*).

Arizona: San Bernardino Ranch, near Douglas, Cochise County, 3,750 ft., August (*F. H. Snow*); Kansas University.

Utah: Rockville, Washington County, along the margins of the Virgin River, May 5, 1943 (*Geo. F. Knowlton*).

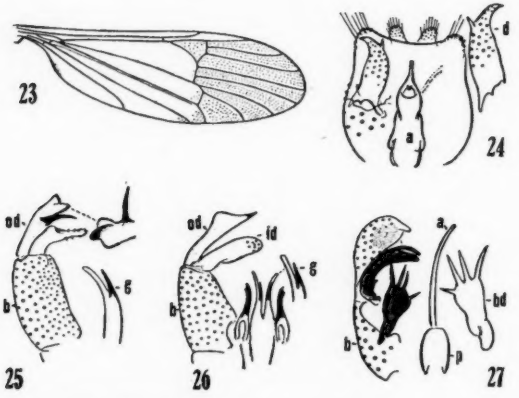

Fig. 23. *Cryptolabis* (*Cryptolabis*) *sica* sp. nov.; venation.

Fig. 24. The same; male hypopygium.

Fig. 25. *Erioptera* (*Empedomorpha*) *empedoides* (Alexander); male hypopygium.

Fig. 26. *Erioptera* (*Empedomorpha*) *apacheana* Alexander; male hypopygium.

Fig. 27. *Molophilus* (*Molophilus*) *arizonicus* sp. nov.; male hypopygium.

(Symbols: *a*, aedeagus; *b*, basistyle; *bd*, basal dististyle; *d*, dististyle; *g*, gonapophysis; *id*, inner dististyle; *od*, outer dististyle; *p*, phallosome.)

The only specimens that I ever collected personally were found along the banks of the Arkansas River, near Cimarron, where they occurred in company with tiger-beetles and other sun-loving insects, all running about actively over the hot unshaded sand.

Just south of the Rio Grande there occurs a second and only other known species of the subgenus, *E.* (*E.*) *apacheana* Alexander, 1946, taken at Granja

Rodriguez, Nuevo Leon, Mexico, altitude 195 meters, along the shore of the Rio Salado; collected at light, June 5-6, 1931 (*A. M. Dampf*, M. F. Nos. 2029, 2047). The two species are most readily separated by the structure of the male hypopygia.

E. (*E.*) *empedoides* (Fig. 25). Outer dististyle, *od*, at apex blackened and irregularly truncate, the margin microscopically toothed or crenulate, near base of the blackened portion bearing a conspicuous blackened spine or narrow blade. Inner dististyle, *id*, broad on basal half, thence narrowed, the tip acute.

E. (*E.*) *apacheana* (Fig. 26). Outer dististyle, *od*, a simple flattened blade, dilated just before the acutely pointed apex, without armature. Inner dististyle, *id*, subequal in length, a little expanded on outer portion, the tip obtuse.

In both species, the inner gonapophyses, *g*, appear as slender yellow rods, each bearing a conspicuous blackened lateral spine.

Some of the records for *empedoides* as given above are based on the female sex and it is possible that the Mexican species may be confused in such material, since it does not seem probable that each species will be found to be restricted to its location north or south of the Rio Grande.

The two species are very striking in the male sex in the greatly dilated and enlarged hairy stigma of the wings. In the female, these latter are normal and have the venation of the radial field undistorted. I am now placing *Empedomorpha* Alexander, 1916, as a subgenus of *Erioptera* Meigen, 1803, rather than recognizing it as a valid genus as heretofore. It seems fairly obvious that the group is allied to *Trimicra* Osten Sacken, 1861, which is now assigned only subgeneric rank. Both subgenera include species that show a surprising range in size of individuals, especially the males, such ranging from very small to unusually large individuals, even though collected at the same place and date.

Erioptera (*Trimicra*) *pilipes* (Fabricius, 1787), var.—Eloy, Arizona, March 14, 1945 (*G. F. Knowlton*).

Erioptera (*Symplecta*) *cana* (Walker, 1848).—New Mexico: Taos Creek, 7,500 ft., July 27, 1934; Frijoles Canyon, June 19, 1942 (*Sperry*); Sierra Blanca, near the Rio Ruidoso, 7,500 ft., May 31, 1942; Mescalero Apache Indian Reservation, 5,000 ft., June 1, 1942. Arizona: Chiricahua Mountains, 6,000 ft., June 4, 1942; Watson Lake, north of Prescott, May 11, 1945 (*G. F. Knowlton*); Clarkdale, near seepage from abandoned swimming pool, May 6, 1945 (*G. F. Knowlton*).

Erioptera (*Ilisia*) *dorothea* Alexander, 1914.—New Mexico: South Fork of Eagle Creek, White Mountains, 8,000 ft., August 16 (*C. H. T. Townsend*). The male hypopygium has been described and figured in the preceding part under this title (Amer. Midl. Nat. 33:432-433, fig. 40; 1945).

Erioptera (*Ilisia*) *lucia* Alexander, 1914.—New Mexico: Beulah, 8,000 ft., August (*Cockerell*); Taos Creek, 7,500 ft., July 27, 1934.

Erioptera (*Ilisia*) *microcellula* Alexander, 1914.—Taos Creek, New Mexico, 7,500 ft., July 27, 1934.

Erioptera (*Ilisia*) *neomexicana* Alexander, 1929.—Jemez Springs, New Mexico, 6,400 ft., June (*John Woodgate*); type.

Erioptera (*Erioptera*) *septemtrionis* Osten Sacken, 1859.—Sapello Canyon, New Mexico, 8,000 ft., August 9-26, 1901 (*Skinner*).

Erioptera (*Mesocyphona*) *caloptera* (Say, 1823, as *caliptera*).—Texas: Davis Mountain, along Limpia Creek, 4,000 ft., May 29, 1942. Arizona: Cottonwood, May 6, 1945 (*G. F. Knowlton*); Clarkdale, May 6, 1945 (*G. F. Knowlton*).

Erioptera (*Mesocyphona*) *eiseni* Alexander, 1913.—New Mexico, La Cueva, Organ Mountains, Donna Ana County, 5,300 ft., September 1 (*C. H. T. Townsend*). Arizona: Chiricahuas, 6,000 ft., June 4, 1942; Santa Ritas, Madera Canyon, 5,000 ft., June 8, 1942.

Erioptera (*Mesocyphona*) *distincta* Alexander, 1912.—New Mexico: Highrolls, Sacramento Mountains, May 31, June 2-10, 1902; Mescalero Apache Indian Reservation, Sacramento Mountains, 5,000 ft., June 1, 1942; Sierra Blanca, 7,500-8,000 ft., May 31, 1942; Taos Creek, 7,500 ft., July 27, 1934 (*M. M. Alexander*). Arizona: Grand Canyon, Indian Gardens, along the Bright Angel Trail, 3,800 ft., June 17, 1942 (*M. M. Alexander*).

Erioptera (*Mesocyphona*) *rubia* Alexander, 1914.—Chiricahua Mountains, Cochise County, Arizona, June 24 (*H. G. Hubbard*); type.

Erioptera (*Empeda*) *cinereipleura* Alexander, 1917.—New Mexico: Near the Cumbres Pass, on the Colorado border, 9,500 ft., July 28, 1934.

Molophilus (Molophilus) arizonicus sp. nov.—Belongs to the *plagiatus* group; size large (wing, male, 5.5 mm. or more); general coloration of thorax brownish black, the surface with a sparse bloom; antennae short; halteres yellow; femora and tibiae obscure brownish yellow, a little darker at tips; wings with a faint dusky tinge, slightly more clouded on the anterior and posterior cords; male hypopygium with the basal dististyle a short compact blackened structure, terminating in four powerful spines; phallosomic plate glabrous.

♂. Length, about 4.5-5.5 mm.; wing, 5.5-7 mm.; antenna, about 0.9-1.1 mm.

♀. Length, about 6 mm.; wing, 7 mm.

Rostrum and palpi brownish black. Antennae short, black throughout; flagellar segments oval; verticils about one-half longer than the segments. Head gray.

Pronotum brownish black. Mesonotum brownish black, the surface a little obscured by a sparse bloom; humeral region of praescutum restrictedly obscure yellow; pretergites light yellow. Pleura brownish black, sparsely pruinose. Halteres uniformly light yellow. Legs with the coxae brownish testaceous; trochanters testaceous yellow; femora and tibiae obscure brownish yellow, a little darker at the tips; tarsi passing into black. Wings with a faint dusky tinge, the prearcular field light yellow; a concentration of dark setae along cord to produce a slightly spotted appearance, the membrane at these places slightly infuscated; veins and macrotrichia darker. Venation: R_2 lying a short distance beyond the level of *r-m;* petiole of cell M_3 nearly twice *m-cu;* vein *2nd A* gently sinuous, ending about opposite one-third to one-fourth the length of petiole of cell M_3.

Abdomen, including hypopygium, black. Male hypopygium (Fig. 27) with the beak of the ventral lobe of basistyle, *b*, a flattened dark-colored blade, stouter in the type (as shown) than in some of the paratypes; face of ventral lobe back from the beak with a large densely setuliferous area. Outer dististyle with the two arms unequal, the outer one slender, gently curved, its tip obtuse; inner arm much broader, more or less scoop-shaped. Basal dististyle, *bd*, short and compact, usually terminating in four powerful spines, these differing slightly in their relative length and thickness and are slightly variable in different specimens. Phallosome, *p*, a suboval glabrous plate, the apex truncate or nearly so.

Holotype, ♂, Chiricahua Mountains, Arizona, in a small ravine below Rustler's Park, altitude 7,500 ft., June 6, 1942 (*C. P. Alexander*). *Allotopotype*, ♀. *Paratopotypes*, 6 ♂ ♀, 7,000-7,500 ft., June 5-6, 1942; *paratypes*, several ♂ ♀, Oak Creek Canyon, Arizona, 5,180-5,200 ft., June 12, 1942 (*C. P. & M. M. Alexander*).

The only other described regional member of the *plagiatus* group is *Molophilus* (*Molophilus*) *ursus* Alexander, 1918, which has the male hypopygium entirely different, particularly the basal dististyle. The latter structure in the present fly somewhat suggests the shape and armature of a bur, the number of spinous points being slightly variable, especially as to relative length and thickness.

Molophilus (*Molophilus*) *colonus* Bergroth, 1888.—New Mexico: Sapello Canyon, New Mexico, 8,000 ft., August 9-26, 1901 (*Skinner*); Mescalero Apache Indian Reservation, Sacramento Mountains, 5,000 ft., June 1, 1942. Arizona: Oak Creek Canyon, 5,180 ft., June 10-12, 1942.

Molophilus (*Molophilus*) *ursus* Alexander, 1918.—Jemez Springs, New Mexico, 6,400 ft., August 21, 1916 (*John Woodgate*); types.

Tanypodinae of Iowa (Diptera)

II. Pentaneura guttipennis (V. d. Wulp)

U. A. Hauber and Thomas Morrissey

On April 7, 1945, material was collected from a pond at the Davenport Country Club and from this material six adult tanypods were reared that have been identified as *Pentaneura guttipennis* (V. d. Wulp). This species, as far as we know, has not been reported from America.

The material in which the larvae were collected was taken in water less than one foot deep and consisted of finely divided vegetable material with very little mud. The adults emerged during May and early June.

The Adults

Identification is based primarily on the color pattern of the wing (Fig. 2) which consists of numerous whitish spots on a dark background. In the female the shaded areas are somewhat more extensive and darker. All femora are pale with the apical fourth darkened; the tibiae are dark, each with a narrow white ring at its base. The leg ratio is about 0.6. The thorax is dark spotted with whitish pruinescence. Halteres pale. Abdomen dark brown with apical margins of tergites pale. Basistyles of hypopygium (Fig. 1) narrowed at base; dististyles five-sixths as long as basistyles with a heavily chitinized, darkened point at the tip. Wing length 2 mm.

The Larvae

We do not have at hand Goetghebuer's (1914) original description of the immature stages of this species, but Zavrel and Thienemann (1921) state that these agree in almost all respects with that of *Peritaphreuusa zavreli* Kieffer which species they describe in detail. Head long, cephalic index about 50%. Antennae (Fig. 5) slightly more than half as long as the head, the basal segment a little more than six times as long as the other segments combined. Ring organ proxical of middle of first segment. Mandible (Fig. 3) darkened only at the very tip, lateral tooth as in *monilis*, with a long bristle which is, however, difficult to see; auxiliary tooth blunt. Maxillary palp slightly tapering, basal segment four to five times as long as wide, and three times as long as the apical segments combined. Ring organ near middle of basal segment. Lingua (Fig. 4) with five teeth, the middle one shortest. Superlingua two-pointed, the pecten with about sixteen teeth on each side. Three large claws of each posterior proleg brownish yellow, the others pale yellow. Anal gills short, one-third to one-fourth as long as prolegs, some of them capped with a brown, chitinous, pointed tip. A long bristle at base of each proleg ventrally and two long bristles dorsally at base of gills. Anal papillae long, with a short curved bristle near the middle and seven long bristles on the end of each one.

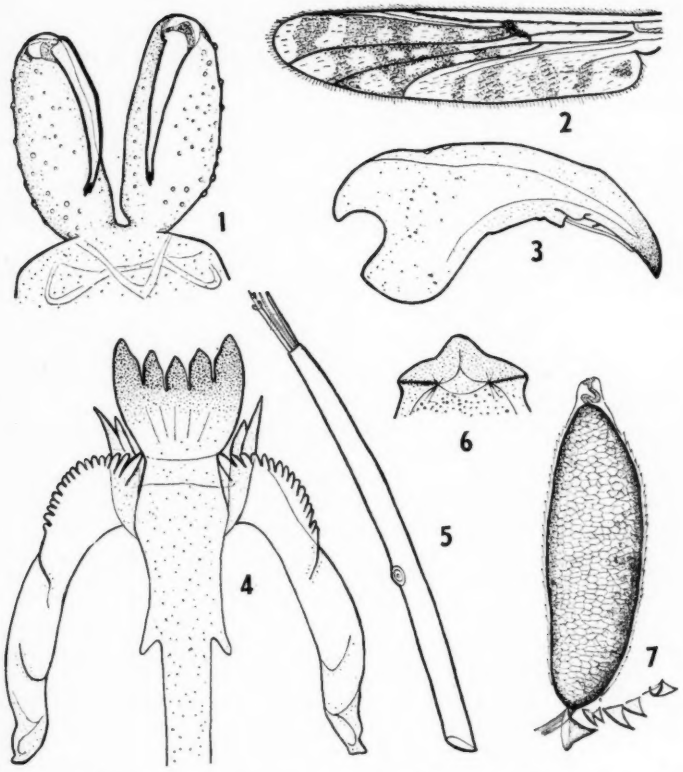

Fig. 1. Hypopygium, x 150. Fig. 2. Wing, x 25. Fig. 3. Mandible of larva, x 500. Fig. 4. Hypopharynx of larva, x 500. Fig. 5. Antenna of larva, x 250. Fig. 6. Operculum of pupal cast, x 85. Fig. 7. Respiratory organ of pupa, x 85.

THE PUPAE

Length 5 mm. Respiratory organs (Fig. 7) brown, oval, about three times as long as wide. Surface of the organ with lace-like markings covered by a thin, transparent sheath that has numerous small prickles pointing distad. Distally there is a pale projection, about one-tenth the length of the organ, containing a coiled tube which broadens at the tip and has a number of minute pores opening to the outside (conf. Zavrel and Thienemann's fig. 20, p. 704). This flattened tip of the tube constitutes a minute sieve-plate. At the base of the respiratory organ there is a broad, hollow, brown tooth and a transverse row of ten clear, smaller teeth, five on each side. There is also a conspicuous brown

projection on the thorax mid-dorsally which is like the large one at the base of the respiratory organ and points cephalad. The operculum is broad and short, the sides concave. The shape of the operculum seems to be a useful diagnostic feature among the species of Pentaneura (conf. Hauber 1945). The abdomen and anal fins are similar to that of *P. peleensis Walley* (Hauber 1945, Fig. 8).

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The Larva of Uranotaenia syntheta

(Diptera: Culicidae)

John E. Porter

Uranotaenia syntheta Dyar and Shannon was described by Dyar 1928 from one female which had been reared from a larva taken in a ground pool by Mr. R. L. Turner. The locality record was given as the Rio Grande Valley, Texas. The male was described by Dampf 1943 from specimens collected in Mexico. The present paper describes the larva and records a few observations on its breeding habits as noted at Fort Worth, Texas.

One male was taken in a light trap operated at Meacham Field, Fort Worth, Texas on July 11, 1944. The only other mosquitoes taken in this collection were two male *Culex tarsalis* Coq. On July 12, 1944 one larva was collected from still areas along the margins of a shallow grass-clogged, flowing ditch along with many fourth-stage larvae of *Anopheles punctipennis*, *Culex salinarius*, and *C. tarsalis* and a number of pupae of *Anopheles punctipennis* and *C. tarsalis*. Most of the ditch is exposed to bright sunshine throughout the day and no part is heavily shaded. The water is cool and clear, the source, a spring being approximately 25 yards from where the larva was taken.

As pointed out by Dampf, *U. syntheta* is a fairly common species in certain sections of Mexico. The records of this species from the United States have been meager but judging from the locations of such collections, i. e., Brownsville, San Antonio and Fort Worth, Texas, all cities with direct airline connections to Mexico City where *U. syntheta* is abundant, it is quite possible that these distributions were established by air traffic.

Description of the Larva of Uranotaenia syntheta

General coloration of the larva pale; the head and lateral margins of the thorax dark brown, the terminal segments of the abdomen pale brown.

Head elongate oval, bulging laterally. Antennae slightly spinose, without any conspicuous hairs; four short and one long papillae at tip. Ante-antennal tuft of nine hairs; upper head hairs coarse and double, lowers long, coarse and single.

Lateral abdominal hairs double or multiple; long and double on the first two segments and short and triple on segments 3 through 6, the 7th and 8th segments with a multiple tuft. Lateral plate of the eighth segment with eight curved teeth located upon the angular portion of the posterior border. Air tube scarcely tapered, approximately 1 x 4.5, with 17 short pecten spines extending to little below the middle, followed by an eight-haired tuft which extends well over half way from its base to the tip of the air tube. Anal segment longer than wide, ringed by the plate which has a spinose posterior

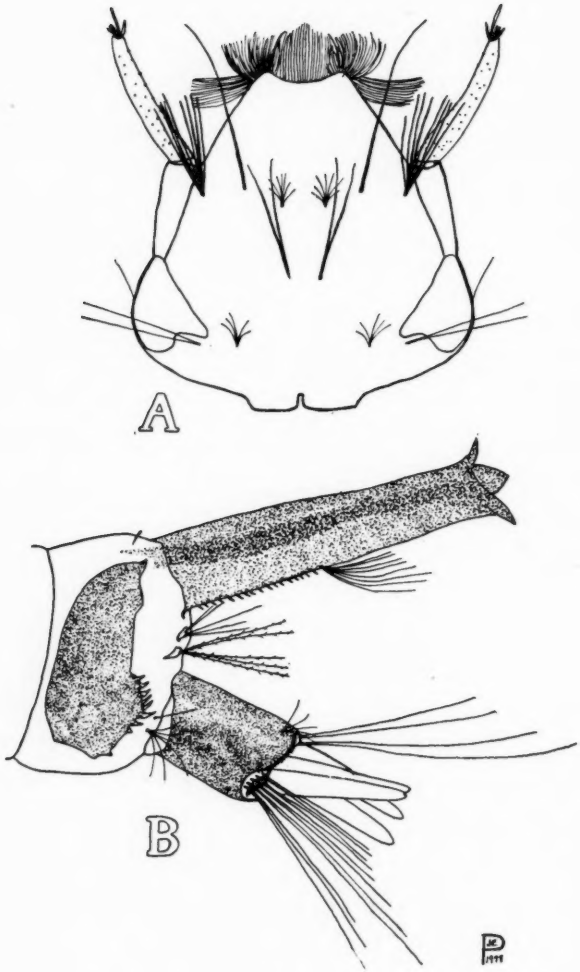

Fig. 1

margin; lateral tuft 5-haired; dorsal tuft of two long hairs on each side; ventral brush of five pairs of branched hairs. Anal gills slender, lanceolate and longer than the segment.

The larva can be separated from *U. lowii* and *U. sapphirina* by the head hairs which in the above-mentioned species are stout, single and spinose and by the lateral plate of the eighth segment which in the case of *U. syntheta* has an angular projection on its posterior margin. The specimen from which this description was made has been deposited in the collections of the Illinois State Natural History Survey, Urbana, Illinios.

It would appear that the larva of *syntheta* cannot definitely be distinguished from that of *U. anhydor* which has only rarely been recorded from San Diego County, California. The presence of two long hairs on each side in the dorsal tuft of *syntheta* compared to the three per side in *anhydor* may prove to be a key character in their separation. The collection of the male *syntheta* the preceding day and the location of the new record also seem to preclude the possibility of the larva herein described being that of *anhydor*.

The author desires to express his thanks to Mr. G. H. Bradley, Senior Entomologist (R), U. S. Public Health Service, MCWA, for his assistance and criticism of the paper; to Dr. Alan Stone, Entomologist, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, USDA, for verification of the determinations of the male and larval mosquitoes and for the many comparisons he made of the larva and male of *syntheta* with specimens of *anhydor* in the U. S. National Museum collections; and to Dr. H. H. Ross, Illinois State Natural History Survey, for his aid in preparing the figures for publication.

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Book Reviews

TEMPO AND MODE IN EVOLUTION. By George Gaylord Simpson. New York, Columbia University Press, 1944. xviii+237 pp. $3.50.

This "first-rank treatise on evolution"[1] which "essays the long awaited synthesis of paleontology and genetics,"[2] "must be studied thoroughly by everyone concerned with the mechanism of evolution"[3] because it is a "stimulating book, undoubtedly destined to be the parent of much new work and many valuable conclusions."[4]

Most of the geneticists and biologists who have reviewed this book, since it became available about a year ago, have justly emphasized the unique qualifications of its author to write it, and its service as a debunking device for some traditional and stereotyped opinions. Some of the reviews, however, have not stressed the author's most original contributions to interpretation of fact and to epistemology.

In the seven chapters the author discusses (1) the rates and (2) the determinants of evolution, (3) micro-, macro-, and mega-evolution, (4) low-rate and high-rate lines, (5) inertia, trend, and momentum, (6) organism and environment, and (7) modes of evolution.

Rate of evolution is practically defined as amount of morphological change relative to a standard although it might "desirably be defined as amount of genetic change in a population per . . . unit of absolute time." The amount of morphological change in a unit character or in a whole organism as an element in a population is found to be extremely hard to measure; in fact "it is still true . . . that subjective judgment of the total difference between organisms is (if made by an able and experienced observer) more reliable than any objective measurement yet devised."

However, survivorship curves for genera of polecypods and for carnivores show that certain lines or phyla evolve at abnormally slow rates while others change unusually rapidly. This investigation of exceptional rates of evolution is probably one of the two most important contributions of the book; the other is the discussion of what Simpson calls *quantum evolution* as a factor in or an explanation of the gaps in phylogenetic records.

Rates of change are variable within and between groups of organisms but the tempo, Simpson states, is not directly determined by morphologic variability or rate of mutation or character of mutation ("amount" of phenotypic effect) or length of generation, but by the relationships of these and other factors to each other and to sizes of breeding populations.

Goldschmidt's systematic saltation theory, which seeks to account for critical gaps in the systematic records of fossils by stating that the "missing links" never existed, is forcefully rejected by Simpson's calculation that five simultaneous mutations could be expected to occur in any one individual (under certain conservative specifications of mutation rate, generation span, and population size) only once in a period about one hundred times as long as the age of the earth. Other computations reveal the adequacy of observed rates of mutation to accomplish the well known historical facts of horse evolution. "It is thus probable that there were at least 1,500,000 new mutations in the ancestry of *Equus* since the beginning of the Eocene, as a minimum for a single genetic locus active in the evolutionary process."

Microevolution and macroevolution are terms to be applied, according to Simpson, to the rise of subspecific groups and of specific and generic groups, respectively. He introduces the term *mega-evolution* for the "large scale evolution" (of families, orders, classes, and phyla) commonly studied by paleontologists, who, as he remarks, have been impressed by the fact that continuous transitional sequences at the mega-evolutionary level are not merely rare but virtually absent. He shares the opinion of many geneticists

1 C. L. Hubbs, *The American Naturalist* **79**(782):271-275, 1945.
2 Th. Dobzhansky, *The Journal of Heredity* **36**(4):113-115, 1945.
3 G. E. Hutchinson, *American Journal of Science* **243**:356-358, 1945.
4 J. S. Huxley, *Nature* **156**(3949):3-4, 1945.

and taxonomists that there are no particular qualitative differences in the mechanisms and processes of "small scale" and "large scale" evolution and that the latter is a kind of extrapolation of the former. Unfortunately these words, as symbols of taxonomic status or of estimated "amounts" of evolution, are now used in diverse ways which encourage the common tendency to confuse evolutionary process with taxonomic category and one level of taxonomic abstraction with another. If macroevolution is regarded as simply the accumulation of enough microevolution (as experimentally observed) to serve as a basis for large categorical distinctions (macrotaxonomy), the word indicates quite a different phenomenon from Goldschmidt's theoretical macroevolution (the origin of the "good" species and the "hopeful monster" by a single genetic step), a reification which he claimed could not even be understood by a knowledge of the facts of microevolution.

Simpson suggests that discontinuities in the fossil record at the micro and macro taxonomic levels may be attributed to accidents of sampling but that the large (megaevolutionary) gaps "cannot, offhand, be imputed entirely to chance" and require special explanation. He makes and discusses several general observations about these major discontinuities which are seen to be "systematic but not absolute" and to occur within single groups, already distinct, of small sized forms which represent major adaptive changes from their ancestors. Morphologic gaps frequently coincide with time hiatuses (as gauged by other means) and with changes in earth history. Numerous common "explanations" for the systematic discontinuities in the record are repudiated in favor of the conclusion that the animals, at the time of the apparent gap, were few in number and were evolving at unusually high rates.

Examples of the tempo of evolution are assorted into three kinds of rate distributions. *Horotely*, the standard (for each group of organisms), is described as being qualitatively different from the nonstandard low rate *bradytely*, and from *tachytely*, a high-rate distribution. "Almost immortal" bradytelic lines or phyla, exemplified by lingulids, limulids, cockroaches, coelacanths, sphenodonts, crocodiles, and opossums, "probably normally arise from tachytelic and often give rise to horotelic or tachytelic offshoots." These bradytelic groups were progressive and not primitive organisms when they first appeared, and their stability and equilibrium was established in continuously large breeding populations so well adapted to a persistent environment that most mutations tended to be eliminated by selection pressure.

Tachytelic groups are rarely represented by fossils but the evolution of *Valenciennesia*, as interpreted by Gorjanovic-Kramberger, is cited as a high-rate example. In general, tachytelic populations are believed to be small and isolated; they either become extinct or originate new major adaptive grades in which the evolving lines become horotelic.

Although there is "no possible doubt but that some degree of rectilinearity [inertia] is common in evolution," the phenomenon "is far from universal" and the observed examples of it occur in groups with large populations evolving at moderate rates. "The possible directions of mutations are limited," but the "evidence decidedly opposes primarily genetic control of direction of evolution."

Simpson regards the belief that incipient or rudimentary structures cannot be favored by selection (a standard statement in favor of orthogenesis) as a forceful argument against orthoselection, but he also finds equivocation in the subjective opinions of various authors that slight variations do or do not have selection values. Several trends in horse evolution are described, with the conclusion that they are "consistent with orthoselection" and "flatly inconsistent with the idea of any inherent rectilinearity." Also, "much of the rectilinearity of evolution is a product rather of the minds of scientists to move in straight lines than of a tendency for nature to do so."

After rejecting much of the alleged evidence for the existence of momentum that may carry phyla "beyond the optimum and that may even cause their extinction," Simpson cites several genetic conditions, including linkage, which might be associated with apparent momentum effects, but concludes that their most general explanation and probably the most general cause of extinction is a change of selective influences which makes specialization secondarily inadaptive. In this situation a phylum approaches or reaches an optimum without passing it and the optimum then shifts faster than the popu-

lation can follow, an aspect of "'lag,' failure of the genotype to produce mutation as rapidly as selection requires."

Adaptation in its complexity is a continual theme throughout the book. In the interactions of organism and environment natural selection is "purely an eliminating, not an originating force" (p. 31) but nevertheless "in the theories of population genetics it is selection that is truly creative" (p. 80) "and not solely negative in action" (p. 96), and in this sense has a "formative influence on the rise of new characters" (p. 181). Two phases of adaptation are particularly discussed. Preadaptation is defined as "the existence of a prospective function prior to its realization," and postadaptation as "the process of specialization by perfecting adjustment to an occupied ecological position, or by secular adaptation." These concepts lead to the consideration of adaptive zones and "grids" and from there to the conclusion that "the change from one zone to another is usually tachytelic."

Three intergrading modes of evolution are classified although any "single mode perhaps does not occur in nature in wholly pure form." Speciation (including raciation) is typified by the local differentiation of two or more groups within a widespread population of moderate size in subdivisions of a single adaptive zone, and may lead, through isolation, to the establishment of genera or "somewhat higher units." This anastomosing evolutionary pattern does not require the incidence of new mutations because "the group variability is parceled out" among the differentiating subgroups. It may be a very rapid process but as a sustained phenomenon this mode implies moderate rates over long periods. It is "almost the only mode accessible for study by experimental biology, neozoology, and genetics" and is also subject to paleontological study.

Phyletic evolution is primarily the sustained shift of the average characteristics of moderate to large size populations, each deployed within a broad adaptive zone, through successive "vertical" species in lines which commonly appear to be directional and are frequently differentiated to the degree that they are symbolized in the middle taxonomic levels, genera, subfamilies, and families.

Quantum evolution is, commonly, the tachytelic shift of a small isolated population from one adaptive zone in which it has lost its equilibrium to another available zone for which it is preadapted. This mode is "believed to be the dominant and most essential process in the origin of taxonomic units of relatively high rank." The scarcity of intergrades (or the presence of gaps) between higher categories, suborders, orders, and phyla may be accounted for by the relatively great speed of this process and the smallness of the populations involved. Indeed "this deficiency of documentation is itself good evidence for the reality of the inferred phenomenon."

Confusion lies ahead in the existing dual use of the term quantum in evolutionary and genetic studies. Simpson applies the word to the magnitude of certain kinds of reactions (geologically fast but genetically slow) between populations and environments. Schrödinger and others compare gene mutations with the quantum jump of physics and suggest that the similarities may be more than analogies, that the mechanism of heredity is founded on the very basis of quantum theory.

Not only does this book present many original, controversial, and stimulating theses and their attendant antitheses but it demonstrates that the author, as a paleontological apologist for genetics (and vice versa), realizes the difficulties of his judgments and the probability that they will be misinterpreted. He has carefully differentiated between frequently confused members of concept pairs, such as symbol and object, being and becoming, explanation and description, fact and report, primitive and generalized, record and "artifact." His style is unvaried but not monotonous.

Ways are indicated to tackle problems which have resisted conventional methods of attack, and many fields for fascinating study are revealed. Simpson frequently (pp. 20, 30, 62-5, 94-5, 121, 137, and elsewhere) mentions generation length as a possible correlate of rate of evolution, but concludes, and with some surprise, that there is no evident direct relationship. This concept should be studied further; long intergeneration spans might correlate more successfully, at least theoretically, with rapid than with slow evolution, depending upon how and when mutations occur.

The extent to which hereditary factors that become expressed only in adults, past breeding age, are affected by natural selection also merits further consideration.

Some omissions from the bibliography of 181 titles were probably occasioned by the

irregularities of wartime distribution of publications and by the author's war duty absence from his desk for some time prior to the publication of the book. There are deficiencies and inconsistencies in the index. All page references to the preface and introduction are wrong.

Paleontologists may wonder why certain figures for geological time were used, despite the authority citations, and will hope that some minor inconsistencies of terminology will be corrected in future editions wherein, also, the reference to horses on a saddle (between adaptive peaks) will probably be deleted or changed.

The book is a major contribution to the expansion and correlation of scientific reasoning in paleontology.—GLENN L. JEPSEN, Princeton University, Princeton, N. J.

ROOT DISEASE FUNGI. A Treatise on the Epidemiology of Soil-borne Disease in Crop Plants, and a First Exposition of the Principles of Root Disease Control, by S. D. Garrett. Volume One of Annales Cryptogamici et Phytopathologici, published by Chronica Botanica Co., Waltham, Mass. (G. E. Stechert and Co., New York City.) 177 pp., 9 figs. 1944, $4.50.

Root Direase Fungi is valuable as the first book length exposition of the facts and principles underlying the activities of root destroying fungi and their control. The organisms treated in the book actually include more than just the root decaying fungi in the strict sense. In many cases references have been made and discussions included of soil borne organisms attacking stems or even leaves. The emphasis is, as indicated, on the root destroying organisms.

The author considers the fungi primarily from the standpoint of their ecology, which is not only a relatively new but somewhat neglected angle of phytopathology. As is true of other books in this series, the interpretations of the facts available and their assimilation into generalized principles is well done. American readers will, however, be disappointed in the absence of consideration of many of our commonest root disease organisms. Except for Phymatotrichum and Ophiobolus, most of the destructive organisms found in our larger crop areas are not discussed or are merely mentioned. This omission may rightly be due to the lack of sufficient knowledge and investigation of the ecology of these pathogens but is rather obvious.

The examples chosen for complete discussion and as a basis for the development of the principles come mainly from the tropical or sub-tropical forms investigated by the British workers.

The book is composed really in two sections. The first, of eight chapters and 81 pages concerns the ecology of the organisms, or as the author states—" . . . discussed the behaviour of the root-infecting fungi, and attempted to demonstrate certain trends in the subterranean evolution of the parasitic habit." The second section, of seven chapters and 68 pages, concerns the facts and principles of the control of certain organisms "under different types of cultivation."

The chapter headings indicate rather well the nature of the material discussed. These include microbiological equilibrium, parasitic specialization, parasitic activity, influence of soil temperature, soil moisture, soil texture, soil reaction, soil organic content and the concentraiton of nutrients on parasitic activity, the saprophytic activity and dormancy of the root-infecting fungi. Some soil-borne stem-infecting fungi are also included in the discussions. These chapters are well written and contain a summarization of a large amount of otherwise scattered data. One might wish, however, that the author could include more of the fungi investigated in other regions and, as is indicated in the title, extend the discussion to all soilborne plant pathogens. The result would undoubtedly be more useful to most plant pathologists.

The discussion of control of the root disease fungi is considered according to the type of cultivation used for the various crops and is divided into those grown under field, plantation and "glasshouse" conditions. The author points out that it is the type of cultivation more than mere geographic location that determines the methods of control applicable to soil-borne pathogens. In the discussion of methods of control the examples are well chosen and the application of the methods is fully explained. In many cases

methods are suggested which might well become the subject of further investigation in many parts of this country.

Dr. Garrett indicates that he did not intend the book as a text. Yet the book, discussing the factors influencing pathogenic organisms in the soil, will certainly be an invaluable source-book for the teacher and serve for references and stimulation for most students. The teacher and student will feel that many points in the book could have been more strongly presented by the incorporation of more illustrations.

—G. C. KENT, Cornell University.

A BOTANICAL VADE MECUM FOR LATIN AMERICA

PLANTS AND PLANT SCIENCE IN LATIN AMERICA. Frans Verdoorn, Ed., in cooperation with 85 collaborators xl + 384 pp. Illustrated. Waltham, Mass. Chronica Botanica Co. 1945. $6.00.

Few indeed are the botanical titles which merit the designation, "books especially noteworthy," as the bibliographer Benjamin Daydon Jackson employed the phrase in his "Guide to the Literature of Botany." But in that future "Guide to the Literature of the Plant Sciences" for which Verdoorn says there is "very great need," the symposium "Plants and Plant Science in Latin America" will deserve the asterisk of outstanding merit!

This symposium is an event in international relations. With his zeal for more effective cooperation between peoples all over the world, Dr. Verdoorn has enlisted the aid of 85 collaborators—a fine tribute to his diplomatic acumen. (The title page alone will keep the technical cataloguers at the Library of Congress busy for days preparing the requisite cross-entry catalogue cards!) These contributions cover Latin America in a most comprehensive way, giving well-digested summaries of phytogeography, economic botany, botanical history, plant ecology, ethnobotany, forestry, bioclimatics—literally a whole library of concise handbooks on these and many other cognate topics. By a clever choice of typography in the usual Chronica Botanica manner, this volume of over 384 pages contains an enormus fund of information for many different classes of readers. Thus, for the plant ecologist it will serve as a new edition of the handy "Naturalist's Guide to the Americas"; for science librarians, as "a selected list of travel books of botanical interest" (pp. xxiii-xxviii)—engaging commentary of a working botanist who is also a book-lover; for the plant taxonomist, as DeCandolle's "La Phytographie," brought up to date for its roster of collectors and the herbaria housing their collections; and for the historian, as a working syllabus from Monardes to the present time, abundantly documented throughout. Supplementing these is Verdoorn's own "introductory bibliography notes . . . supplementing various [contributed] articles" (pp. xxix-xxxv).

Fortunately the book, unlike some others published during the war years, was printed on good paper of enduring quality. The reproductions include selections from the works, among others, of Marcgrav, Martius, Bellerman, Schenck, and Andre. The Weitsch engraving of Humboldt as a youth (plate 28) is of unusual interest—Von Hagen, in his "South America Called Them," has a commentary upon this portrait. The lack of a comprehensive subject index is obvious but the editor felt, in view of the polyglot nature of the textual contributions, that its preparation was "not feasible." It would seem that the many fine plates—there are 38—might have been better placed with concern for the text, avoiding their interpolation with the terminal table of contents. The dedication page to Humboldt should have followed the foreword directly. The index of personal names covers six and a half pages, printed in five columns.

Let it be noted that the very publication of the book in difficult war years is a testimony of the workableness of the editor's belief in international cooperation. Indeed, we have now a botanist's *vade mecum* for Latin America, or an "elbow-book," as I like to call its kind, of permanent value as a reference work.—JOSEPH EWAN, Smithsonian Institution, Washington, D. C.

THE DISTRIBUTION OF THE BIRDS OF CALIFORNIA. By Joseph Grinnell and Alden H. Miller. Cooper Ornithological Club, Pacific Coast Avifauna number 27, 608 pp., col. front., 57 maps. Berkeley, Calif., 1944. For sale by W. L. Chambers, Bus. Mgr. Cooper Ornith. Club, Topango, Calif. $6, paper covers; $7, buckram.

This important book supersedes Grinnell's "A Distributional List of the Birds of California," which appeared nearly a third of a century ago as number 11 in the Pacific Coast Avifauna series. In the succeeding interval much new information on Californian birds has been accumulated, especially by the large group of bird students of the state, both amateur and professional, making highly desirable a revision of that paper. This revision is particularly important because of the abundance, diversity and critical nature of the ecologic and taxonomic problems in the area covered by it. The broadness of the authors' experience and their intimate knowledge of California provide an especially sound basis for critical judgment. The book should be in the hands of everyone interested in western birds and will be a standard reference for all interested in faunistic problems.

At the time of his death in 1939, Grinnell was actively at work on this task and had about half of it in manuscript form. The rest was written and the first half brought up to date by the junior author, who was well qualified to carry on Grinnell's plans. These authors have produced a book which is a fitting monument to their knowledge of the birds of that state and to the activity and cooperation among students of Californian birds in general. Despite the title, this work is more than a record of present knowledge of the distribution of birds in California. It is, in addition, a guide to the literature and a summary of the habitat choices of the various species.

Preceding the body of the book is a list of the species and subspecies of birds (other than fossil) known to have occurred naturally within California. These are arranged systematically, and the larger taxonomic categories in which they belong are indicated. Only those forms substantiated by specimens are included. In contrast to recent tendency elsewhere, introduced species are omitted. The total of 644 species and subspecies testifies to the activity of bird students in the state and to the state's strategic geographic position. The large number (423) breeding within the state is indicative of the physiographic and climatic diversity of the area.

In the detailed account of each species are given latin and vernacular names, a list of synonyms (both latin and vernacular) which have been used with reference to California, seasonal status and abundance in California, geographic range in the state, and habitat. Occasionally, taxonomic comments are appended, when the treatment is not in line with current usage or with recent suggestions by others. Reasons for this deviation are given but not discussed.

The geographic range is given in detail, not only in terms of localities but also outlining the altitudinal distribution. Seasonal variations are indicated. In this delineation, marginal and unusual records are well documented with references to literature, to specimens, and to previously unpublished manuscript notes from several sources. Thus it is easy for one to obtain more information on such records and to assess their significance for himself.

In the same section are given additional selected references to published information on various aspects of the natural history of the species. The book is thus, in reality, an introduction to published knowledge of Californian birds. Included are general references and citations to reports of habits, food, habitat, distributional summaries, migration, breeding, etc. In the reviewer's opinion this is an outstanding feature of the book, not only for persons beginning the study of Californian birds but also for the great majority of students, who do not have time or means of keeping in touch with the many publications on these topics which appear every year.

One of the best features of the book is the section on habitat. Therein is given a brief characterization of the ecologic distribution of the species in rather precise terms. Not only is the general association given, but the specific places used by the bird within the association are noted. In addition, for most species there is mention of some of the most important ecologic factors in the habitats and their relation to the bird's distribution. For example may be quoted the habitat section for the Pacific Audubon Warbler: "In summer, coniferous forests of wide variety, occurring in all types of pines, firs, and

hemlocks found above the Upper Sonoran Life-zone. The needle tufts of the trees are searched in foraging partly from the outer surface by flying out beyond the edge of the cover and returning to it. Part of the insect food is caught on the wing. Rarely nesting occurs in broad-leafed trees in meadows or in orchards. The coniferous forests occupied vary in type from dense shaded tracts of Douglas fir to open yellow pine and stunted, well-spaced, timber-line pines of several species. Cruising range in foraging extends from the ground up to the tops of the tallest trees. The combined singing and foraging of males is, however, chiefly at middle heights or in the tree tops. Nest emplacements range from 3 or 4 feet up to 100 feet above the ground. In winter, the habitat is highly varied. The birds turn to flycatching in the open, to ground foraging, to berry eating and to sipping nectar in addition to searching foliage surfaces. These varied activities lead them to all manner of plant cover, but especially to open foliage, tree and bush tops, to strand lines, faces of cliffs and walls, and to grassy patches of ground."

It is to be hoped that this method will be used by other authors, for it has great usefulness for synthetic and comparative studies. Most important, it summarizes in concise form the prseent state of knowledge, which can be checked and added to in future field work, even by persons previously unfamiliar with a given species. To the person looking for certain species for the first time, it provides a helpful guide, especially in diversified country. Such information usually is gained only through long field experience.

Following the detailed treatment of native species is an annotated list of birds introduced into California by man, escaped from aviaries, seen but never collected in the state, and incorrectly attributed to California for various reasons. The status of each species is described, and, for introduced forms which have become established, the history of known introductions is reviewed and the present range in the state is outlined.

The book closes with an index to the names (vernacular and latin) of the species and genera treated.

Frequent maps illustrate the geographic breeding distribution within the state of most species with two or more races nesting therein. Sharp boundaries are shown between the ranges of adjacent, intergrading subspecies rather than zones of intergradation.

This reviewer believes that the authors' emphasis on the incompleteness of knowledge of Californian birds will do much to stimulate rapid acquisition of more information, especially by amateur ornithologists. It strikes a note which is quite in contrast to that of finality used by too many writers of monographs. As the authors point out in their introduction, such simple facts as "dates, places of occurrence, and identification" are incomplete for many species. Fairly complete information on these items would be of much value in other biological studies as well as in those concerned with distribution. Undoubtedly, much of this information has been gathered but not published, and much more could be gathered with little trouble.

We like the care and precision which have so obviously gone into the preparation of this report. It is not a hastily done piece of work; it shows the thorough consideration and careful checking to be expected of these authors, and of Hilda Wood Grinnell, who did much of the bibliographic work.

As in any book of this type, there are a number of controversial problems, on which it probably would be impossible to get unanimity of opinion. Examples are the use and formulation of vernacular names, the weight to be accorded sight records, the inclusion of a long nominal list in addition to the annotated list, and terms used in indicating frequency. The treatment accorded such problems by Grinnell and Miller has definite merits in each case and has produced a highly useful book, which is the main objective. It will be referred to often by all types of students of birds.—FREDERICK H. TEST, University of Michigan.

	Homology	
	Hypothetical limb	Man
Pectoral girdle	Clavicle	
	Scapula	
	Coracoid	
Fore limb	Humerus	
	Radius	
	Ulna	
	10 carpals	
	5 metacarpals	
	14 phalanges	
	5 digits	
Pelvic girdle	Ilium	
	Ischium	
	Pubis	
Hind limb	Femur	
	Tibia	
	Fibula	
	10 tarsals	
	5 metatarsals	
	14 phalanges	
	5 digits	

Homology Chart

Man	Frog

Bird